ARCHIVES OF OTOLOGY.

CLINICAL OBSERVATIONS UPON THE DISEASES OF THE MASTOID PROCESS, WITH AN HISTORICAL SKETCH OF THE ORIGIN OF OPERATIONS UPON IT.*

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THE object of the following paper is to present a picture of diseases of the mastoid process, as seen in the private and hospital practice of a specialist in New York. The notes of the cases occurring in my private practice have been rather carefully taken in most instances, and the record may be relied upon to give a fair idea of the frequency with which mastoid disease is seen in special practice, and also of the nature of such disease. These notes, however, fail to give an accurate idea of how many times the mastoid process is actually affected, in a given number of cases of diseases of the ear, taken just as they occur in a community.

Strange as it may seem to some, acute aural disease does not reach the specialists in any such proportion as do the chronic affections, especially of the non-suppurative variety. There are many reasons for this—for example: Many general surgeons, who would not meddle with a chronic disease of the ear, feel themselves entirely competent to manage an acute catarrh or acute suppuration with mastoid periostitis. Then, also, there yet lingers, even in the minds of many who are friendly to specialists, an idea that we are only of use when all the resources of the general practitioner are exhausted, that we have special principles of treatment which come in when general principles fail.

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We are also considered, in some quarters, in spite of our protests, as office practitioners merely, who decline to see cases serious enough to confine the patient to the room. Such reasons as these render the proportion of mastoid affections seen by a specialist smaller than would perhaps be generally supposed.

The hospitals and infirmaries give a more correct idea of the proportion of acute aural disease in general, and of mastoid disease in particular, for the poor have found out to a much larger extent than the well-to-do, that the best assistance in acute aural disease is to be found among those who give special attention to it. But we must take facts as they are, and I venture to present my rather commonplace statistics to the kindly consideration of this learned body. They may show something of what has come to me in this direction in the last twenty-two years.

I present the notes of 59 cases of affections of the mastoid process, in 5,797 cases of aural disease, which have occurred in my private practice in that time. Occasionally, I have omitted to record one which I have seen in consultation, but there are not many such, so that the record is tolerably exact.

I also present statistics of 33 cases observed in my practice at the Manhattan Eye and Ear Hospital in the last eighteen years. I am obliged to say that, until very recently, we have not had, in the press of work at that institution, the facilities for keeping full notes of all the cases, so that the record is very incomplete. The total number of cases that have been diagnosticated as affections of the mastoid, in all the aural departments of this institution for eighteen years is 110.

Here, also, there is a source of error, for some cases that entered the hospital, and were diagnosticated as simple catarrh or suppuration, finally became cases of mastoid disease. Besides this, many made but a few visits and never returned, so that we knew nothing in many instances of the ultimate results. At the close of the paper, will be found statistical tables in more or less detail of the total number of cases.

I have selected for your consideration this evening only the striking ones of which tolerably complete histories are given, and those which have not been heretofore published. Those which have been published already, are indicated, and the source where they may be found, given, so that the student who is interested in this part of literature may make this paper more complete by referring to them.

As a matter of historical justice to some American writers and surgeons, among whom I may venture to place myself, I have also added an historical sketch of the literature and work upon diseases of the mastoid process, for the last ninety years.

A summary of all the cases here reported shows as follows :

Summary of Cases in Private Practice.

No. of cases treated, males	33		Result : Died	9	
" " " " females,	26	59	Cured	36	
			Relieved	10	
			Unknown	4	59

The disease of the mastoid occurred in the following named affections :

Acute catarrhal inflammation of the middle ear	11
Acute suppuration of the middle ear	25
Chronic suppuration of the middle ear	18
Primary mastoid periostitis	1
Inflammation of the external auditory canal	2
Exostosis of the mastoid	1
Neuralgia of the middle ear	1
	59

OPERATIONS.

Wilde's incision made with evacuation of pus	9
Wilde's incision without pus	11
Mastoid opened by enlarging fistula	16
Opened without finding fistula	4
Opened through external auditory canal	2
	42

Summary of Cases Treated in the Writer's Clinique at the Manhattan Eye and Ear Hospital.

No. of cases treated	33	Result :	Cured	14	
			Relieved	5	
			Died	1	
			Unknown	14	33

DISEASE.		OPERATIONS.	
Acute catarrh of the middle ear	2	Wilde's incision	7
Sub-acute catarrh of the middle ear	1	" " pus evacuated	5
Acute suppuration, middle ear	8	Opening mastoid with a drill	14
Acute suppuration of the middle ear, with mastoid fistula	1	Treated without operation	7
Sub-acute suppuration of the middle ear	1		33
Chronic suppuration, middle ear,	11		
Chronic suppuration of the middle ear, with mastoid fistula	4		
Chronic suppuration, middle ear, with polypus.	1		
Chronic catarrh of the middle ear,	1		
Primary inflammation of the mastoid	2		
Impacted cerumen with mastoid periostitis	1		
	33		

First, the **cases in which death occurred.** There were ten of such cases in private practice and one in the hospital cases. One of the deaths was probably not induced by the aural disease; but the others are undoubtedly to be classified in this way:

CASE 1.—*Suppurative inflammation of the middle ear soon after birth; mastoid periostitis; incisions; death.*

Boy of three months of age, seen in consultation with Dr. M. W. Williams. There was an abundant discharge of pus from the tympanum. Considerable œdema of the mastoid, and evidences of meningitis. Dr. Williams had incised the tissues down to the bone before I saw the patient. I repeated this incision a few days after. No pus was found. Inasmuch as there was free drainage from the tympanum, no further operation was performed. The patient died in a few days afterward.

CASE 2.—*Suppuration of the middle ear for six years; death.*

Female, æt. fifty. Four years ago she had an attack of severe pain and swelling in the right ear from which she recovered, but a discharge remained. One year ago she had acute inflammation of the mastoid process. The integument and periosteum were incised, pus discharged for two months and then ceased. Two weeks ago the inflammation recurred in the same part. There was intense pain in the ear, and an offensive discharge from it; the latter continued. H D, R $\frac{6}{30}$, L $\frac{c}{30}$.

The patient has been living in a malarial district, and has taken largely of quinine.

The left auditory canal is narrowed and crooked and filled with pus. The drum-head is nearly gone, and there is caries of the tympanum, the mastoid cells, and posterior wall of the auditory canal. Dr. E. T. Ely saw the patient for me at first, and advised the application of six leeches and the hot douche every three hours. In a few days the patient was much better, the mastoid was not tender, but there was intense pain in the head and constant vertigo. The bones of the tympanum were gone, and the foramen ovale probably opened. I learned afterwards this patient died very soon after Dr. Ely and I saw her, which we did but a few times, when we were dismissed.

CASE 3.—*Acute suppuration of the middle ear; mastoid periostitis; meningitis; death.*

This case has already been published in full (*Medical Record*, July 7, 1877; also p. 310, author's treatise). It is simply necessary to say here the patient died of meningitis from acute suppuration of the middle ear, in twenty-eight days from the first attack of aural inflammation. Wilde's incision was made, but no disease of the bone was found, and the post-mortem examination showed that such an opening would have been in vain.

CASE 4.—*Chronic suppuration of right middle ear; mastoid swelling; abscess; opened with drill; died about three months after from meningitis.*

Male, æt. twenty. Under the writer's observation for about fourteen days.

The patient has had a discharge from his right eye ever since infancy. The drum-head of that side is gone, and there is a very free discharge of pus from it. The whole surface of the mastoid is swelled and excessively tender. A free incision was made down to the bone and a fistula was found leading into the tympanum. This was enlarged and a tent introduced and poultices applied. The patient remained under daily observation in New York for eight days, when he returned to his home to be under the care of his family physician. I saw him once or twice afterwards. He did well until July or August, when he died suddenly at a watering place, as I was informed, from meningitis.

CASE 5.—*Bronchitis; acute suppuration of the right middle ear; chills simulating ague and fever; mastoid abscess opened with a drill; death four days after.*

D. I., æt. sixty-nine, on April 6, 1886, was sent to my office by Dr. M. H. Williams with the following history: He had acute bronchitis three and a half months before, which in about two weeks was followed by earache. This ceased when the ear began to discharge, but the suppuration has continued ever since. The ear was carefully cleansed with warm water and an astringent instilled, and the ear was inflated by Politzer's method. There was occasionally some bleeding from the tympanum on cleansing.

The patient has excellent care under good hygienic conditions. To-day the patient has no pain, slight tinnitus occurred, but no other aural symptom.

H. D. $\frac{P}{40}$ L. $\frac{14}{40}$. Bone-conduction better than aërial on that side. When the tuning-fork is placed on the sound mastoid it appears to be heard on the diseased side. This is a symptom which, as is well known, is quite often seen, and when it is, always in my opinion indicates advanced disease of the tympanum and cells, not necessarily suppuration however, with greatly increased resonance of these parts. The nares are in a catarrhal condition. The posterior half of the drum-head is swept away, the remainder is red; a rather thick discharge from the tympanum. No tenderness, pain, swelling, or redness of the mastoid. Simple cleansing was advised. Nearly a month after, on May 4, 1886, I again saw the patient at his house and got the following history from Dr. Williams. The patient was doing fairly well until April 31st, when he had a chill followed by fever. He has had a chill nearly every day since. The mastoid is slightly tender at the apex, there is no œdema and no pain, but that side of his head feels uncomfortable. The next day the uncomfortable sensation had increased, and the usual incision was made through the integument and the bone opened with a drill. The depth reached was about one half an inch, when pus flowed out in considerable quantity. A tent was inserted and a poultice applied. In the evening the patient was very comfortable. Temp. 98½°. Pulse 78.

May 6th.—The patient had a chill lasting half an hour, and his temperature went up to 104⅕°. Two days after he died, hemiplegia having occurred.

CASE 6.—*Chronic suppuration of long standing; great pain in the head; delirium; opening of the mastoid; death.*

Male, æt. twenty-five. This patient was seen twice in consultation. The history was that he had had a suppurating ear on the right side for many years, and occasionally he has been laid up with earache. He has been sick now for two weeks. Pulse 90. Temperature 104°. The tympanum is suppurating moderately. The apex of the mastoid process is tender upon firm pressure, but there is no pain except in the head and that is not severe. The previous treatment has been the use of quinine and the application of leeches.

The diagnosis was meningeal hyperæmia from acute suppuration supervening upon chronic suppuration. Four leeches were advised, and poultices around the ear. I heard nothing more of the patient until fifteen days later. I was again sent for. The physician in attendance concluded that the high temperature was due to malarial poisoning, and has given large doses of quinine. He also made an incision through the periosteum of the mastoid process which has nearly healed. The patient is now delirious, flinches when pressure is made upon the mastoid. The mastoid was opened with a small drill into the cells. No pus was found. The blood was exceedingly dark, but there was no serious hemorrhage. The patient died three hours later. At my first visit to this patient I thought and expressed my opinion that the pus that formed on this case was probably inaccessible, for I supposed that the apex of the petrous bone or the roof of the tympanum rather than the mastoid was the principal seat of the disease. I did not concur in the use of the quinine, and never supposed that there was any determining malarial element in the case. When I got consent to opening the mastoid I did not hesitate, however, for I think many lives have been lost because concealed pus has not been evacuated in such cases. With my present convictions, in dangerous suppuration of the tympanum, I shall always lean towards opening the mastoid, believing as I do that such an opening secures the best drainage possible for the tympanum. Much as I deplore unsuccessful cases, I shall never hesitate to perform what I believe to be an operation almost without danger—in a doubtful and dangerous case. In a case to be described hereafter, occurring in the Manhattan Eye and Ear Hospital in my service and operated upon by Dr. Emerson with my assistance, a case almost desperate, life was, I think, saved by a timely trephining, although no pus was found.

CASE 7.—*Chronic suppuration of the middle ear since infancy; acute otitis; spontaneous opening of the mastoid process; enlargement of the opening; phthisis pulmonalis; death.*

C. P., æt. twenty-one. It is doubtful if death in the following case was due to the aural disease. Certainly it was not a result of any operative interference or other treatment. About three months after he was seen by Dr. Ely and myself in consultation with Dr. F. A. Utter, he died of phthisis pulmonalis. The history stated that the patient had had a discharge from the left ear for a long time from early youth. Four weeks ago he had violent pain in the ear extending to the side of the head and neck, a swelling in the mastoid opened spontaneously a few days since. The patient is very pale and weak. Temp. 98⅘°. Pulse 120. The entrance to the auditory canal is obstructed by granulations from the posterior wall. There is a small sinus below the tip of the mastoid. Rough bone is felt at the bottom. He has no pain now. The opening was enlarged and a tent inserted. The tissues are very boggy.

The patient got better so as to be up and about, a free opening into the mastoid cells was maintained, but the patient died in three months after.

CASE 8.—*Chronic suppuration of the middle ear; extensive necrosis of the mastoid process; epithelial tumor extending into the cranial cavity; no external swelling; death.*

In consultation with Dr. Mathewson. This case has been fully reported elsewhere (Transactions of the American Otological Society, 1878). This patient was a young married woman in good general health, who had had a purulent discharge from the left ear for ten years. When first seen by Dr. Mathewson and subsequently by myself, she was suffering pain from the ear. There were fungous granulations springing out of the tympanum. There was no swelling, tenderness, or pain in the mastoid.

Four months after first coming to Dr. Mathewson he opened the mastoid, which was still not swollen or tender, and very extensive necrosis was found. Two months after I again saw the patient. There was considerable pain in the head and ear. The mastoid opening was nearly closed. The canal was obstructed by granulations. The next day Dr. Mathewson removed many pieces of dead bone; a wide opening remained down to the dura mater. The patient died two months later, eight months after she came under Dr. Mathewson's care. A full account of the post-

mortem examination of this interesting case appears in the report. From this it appears that the growth had its origin in the tympanum, and that the mastoid was affected only at a late stage.

CASE 9.—*Acute suppuration of the middle ear; redness and swelling of the mastoid; bronchitis; fistula of mastoid enlarged; death.*

Male, æt. three. Seen in consultation with Dr. Emerson. The patient has had a discharge from his left ear for the past six weeks. For two weeks there has been redness of the mastoid process of that side, and slight swelling. There is no fluctuation nor tenderness on pressure. The auditory canal is much swollen. Dr. Emerson advised the hot douche and poultices, and nine days after he was called by Dr. Harrison to see the patient again. He learned that the little patient had had pain for two days. The swelling of the mastoid had nearly disappeared. There was no redness, but there was pain on pressure. The next day I saw the patient with Dr. Emerson. He made a Wilde's incision, found a fistula in the bone, which he enlarged. The patient slept well the night after this, but he died three days after in a convulsion.

DEATHS FROM CASES OCCURRING IN HOSPITAL PRACTICE.

The only death I have seen from aural disease in my service at the Manhattan Eye and Ear Hospital for eighteen years occurred last summer, and was that of a patient under the care of Dr. Emerson and myself.

CASE 10.—*Sub-acute suppuration of the middle ear; mastoid tenderness; opening of bone; no fistula or pus found; death in forty-two days.*

Male, laborer, thirty-seven, was treated as an out patient for two weeks before he entered the hospital. He said he had a painful ear for three weeks before this. The warm douche and leeches have been used. On admission to the hospital, on June 9, 1877, he complains of dizziness and pain. He was found to have a sub-acute suppurative process in the middle ear. He apparently improved under local treatment for three days, when he had a chill and his temperature went up to 103°.

The mastoid was opened by Dr. Emerson, assisted by myself, on that day. The bone was drilled to the depth of one inch. No pus and no fistula were found, and there was no softening of

the external plate. The temperature fell to 100° that evening, but it rose the next day to 103°. The patient was chilly, nauseated. He continued to suffer from nausea for several days; his temperature ranged from 101° to 103°, and on June 21st it arose to 105°. On this day his pulse was increased to 80 for the first time. It had before ranged from 72 to 76. He now has delirium at times. He is given quinine and bromide of potassium. On the 22d he had a chill lasting an hour. The discharge of pus from the ear is scanty. He continued in about this way for three days, when his temperature fell to 98½°, and the next day to 97°. He continued to have chills, and on June 28th his pulse was 120. An examination of the optic nerve and retina showed nothing abnormal. From July 5th the following notes were made by the house surgeon, Dr. Rogers:

July 5th.—More discharge from fistula. Mental condition unchanged. No sleep last night; greatly emaciated. Slept three hours P.M. Chill at 10.30 P.M.

July 6th.—Slept some; cough at times. Condition like yesterday. Sleeps with eyelids half shut. Profuse perspiration. Chill at 6 P.M.

July 7th.—Did not sleep well. Violent; wanted to go home. Sleeping, 8:30 A.M. Complains he can't see as well as two days ago. Does n't take as much nourishment. Iod. potass.

July 8th.—Deviation of both eyes was noticed this P.M.

July 9th.—Slept well. Anodyne continued. Iodide discontinued. Perspiration not so profuse. Seems stronger; pulse and temp. normal—P.M., 72, 98⅘°.

July 10th.—Same as yesterday; appetite good. P.M., chilly sensations.

July 11th.—Slept well. More discharges from fistula. Mind wanders.

July 12th.—Did not sleep. Violent delirium. Appetite not so good. One P.M., severe chill and temp. 102⅘°. Drs. Webster and Emerson at 4 P.M. diagnosticated marked change in optic nerve, left eye, less marked in right; both pupils sluggish and dilated. Mydriasis most marked in left eye.

July 13th.—Slept badly; expectoration of considerable mucus, stringy and about half-brownish color. Evidences of consolidation on right side.

July 14th.—Slept well. Appetite good; increased stimulant to 4 oz. per day. Free perspiration.

July 15th.—Slept considerably through the day. More pus in mastoid opening than usual. Temp. at 7 P.M. 104°. Cough and expectoration continues.

July 16th.—Appetite poor. Pus corpuscles abundant in sputa (?); delirium marked; tendency to cry. More pus this P.M.

July 17th.—More quiet; clot of blood in sputa, dark-colored, probably from post-nasal region. Appetite good. Rests well.

July 18th.—Expectorates freely. Temp. rises to 104° at 7 P.M.

July 19th.—Morning temp. 100°. No general change from yesterday.

July 20th.—Very restless last night. Out of bed continually unless closely watched. Appetite good. Morphine, chloral, and bromide of sodium given every six hours.

July 21st.—Tendency to cry. Less violent and expectorates less; bowels more constipated; takes nourishment well.

July 22d.—Slept well; more rational.

July 23d.—Pleuritic pains, right side.

July 27th.—Picks bedclothes more than for past few days. Seems weaker; pulse and temp. higher.

July 28th.—Only slight expectoration. Takes only liquid foods.

July 29th.—Urinates unconsciously. Cough easier; much mucus in throat.

July 30th.—Temp., respiration, and pulse quickening.

July 31st.—Sinking slowly. Died at 12:10 P.M.

This case was, I think, one of septicæmia, and the purulent infection was in the roof of the tympanum or at the apex of the petrous bone. We were not hopeful of the results of opening the bone, but we desired to obtain an outlet for pus, but in this we were not successful.

I will next discuss the **cases in which a cure resulted after operation,** and will select a few cases from the table for this purpose.

CASE 11.—*Caries of the mastoid from chronic suppuration of the middle ear; mastoid opened three times; recovery.*

Miss X., æt. twenty-six. As this case is reported in my book on the ear, p. 529, I will simply say that the patient was under observation and treatment for some eight months. Although the bone had been opened twice before I saw the case, once with a

chisel, the patient, who is a teacher, was unable to do any mental work on account of pain and dizziness. After a thorough opening up of the old fistula with a drill, and subsequent persistent curetting of granulations, the patient entirely recovered; the drum-head did not heal however; she resumed her duties, which, ten years later, she still continues to perform without trouble from her ear.

To my mind, a case of mastoid disease arising in the course of a chronic suppuration always, or nearly always, involves a tedious course varying from two to six months if cure results. It is otherwise with the same form of disease arising in the course of acute catarrh and acute suppuration. In such cases the recovery may be rapid and death also may speedily result. He who succeeds in curing cases where he has opened the mastoid *de novo*, or enlarged a fistula, must expect weeks of rather dreary work of keeping the opening free, by frequently curetting the granulations, picking away the minute fragments of dead bone, pushing in a tent, a drainage-tube, or the like. With such patience, success will generally crown the effort.

I am very unwilling to operate upon a case unless either one of my staff or myself or a competent surgeon, alive to the importance of the prevention of retention of pus, have the subsequent charge of the case. The after-treatment, I think, invokes much more skill than the operation.

CASE 12.—*Caries of mastoid of nasal bone and of jaw; removal of pieces of dead bone from various parts; recovery.*

Female, æt. five. This case also illustrates what has just been said on the subject of keeping up the openings in the bone until the last of the unhealthy tissue is removed.

The child was apparently a healthy one of healthy parents. She was sent to me by the late Dr. Lewis Fisher, and she was under the care of Dr. Ely and myself for more than four years. A mastoid fistula existed when I first saw her, when she was three years of age. Dr. Abbot, dentist, of this city, had the care of the caries of the jaw; she was etherized several times, to keep open the original enlargement of the bone fistula and to remove granulations from the tympanum. Finally she recovered with a neoplastic non-suppurating tympanum, and the mastoid fistula healed.

Several cases have recovered without perforation of the mastoid by, getting the patient in bed under the charge of a trained nurse, and the free use of the warm douche, leeches and poultices. Most of the patients who have been thus relieved have been of decided neurotic tendencies, and although they have had great tenderness and pain in the mastoid, have probably never had more than periostitis. No caries occurred, except in some instances caries of the wall of the auditory canal, when it opens into the mastoid.

I have written upon this subject at some length in the ARCHIVES OF OTOLOGY, vol. viii., p. 255, and I will not repeat what I then said.

A case which I have lately seen in consultation with Dr. F. W. Ring, and which we treated together in the Manhattan Eye and Ear Hospital, re-illustrates the points I then endeavored to make.

CASE 13.—*Acute suppuration both middle ears; red, sensitive, and tender mastoid; increase of temperature; no operation; recovery.*

Mrs. G., æt. twenty-five. *Nov.* 30, 1886.—Five months previously the patient suffered from acute suppuration of both middle ears, while in the West Indies. The suppuration and pain have continued at intervals ever since.

Occasionally she is quite well. She has been under Dr. Ring's care for more than two months. Under his treatment the right drum is now healed; R *h d* $\frac{48}{48}$. Bone-conduction better; L *h d* $\frac{L}{48}$; B C better. There is pus in the left tympanum. The mastoid of that side is reddish, painful, and tender. The temperature at about 11 A.M. was 102°, and had been for a few days. She was anæmic and neurotic. She lived in a boarding-house and had insufficient care. On the advice of Dr. Ring and myself she was admitted to the hospital. She was kept in a quiet room, was fed with milk, chiefly stimulants, latterly champagne was given pro-re-nata, massage. Her temperature sank to normal in a few hours after getting under hospital care. The right drum-head again broke down, but finally healed. Locally the hot douche and poultices were used. She was discharged cured. She went to Chicago, had a mild attack of acute suppuration without mastoid trouble, from which she completely recovered in twenty days.

One of my cases at the Manhattan Eye and Ear Hospital, one in which I found a fistula in the bone and enlarged it, developed acute facial erysipelas. The temperature, without the administration of medicine, fell in one day from 104° to 97°. The shock was great, but the patient rallied and made a good recovery. The drum-head healed. Facial erysipelas also occurred in another case where the operation of drilling the bone was performed by Dr. F. Tilden Brown, then one of my assistants. This case may be found in my book, page 522, and in these ARCHIVES, vol. xii.

The following case, which occurred in private practice in consultation with Dr. E. M. Pulling, and has a peculiar interest from the fact that *descending optic neuritis resulting in atrophy occurred.*

CASE 14.—Willie X., æt. six. *April* 10, 1885, has had pain and discharge from his right ear for some days. He is in bed. Temperature 100½°. The right membrana tympani is perforate. There is inspissated pus in the tympanum. The mastoid process is red and swelled. An incision was made down to the bone, about one ounce of thick pus was evacuated. The periosteum was found to be extensively diseased, but no fistula in the bone was found. The patient slept well that night and recovered. Case went on well as to the ear. Dr. Pulling afterwards made counter-openings to prevent burrowing, but no opening in the mastoid bone was ever made, and on March 2d of this year I again examined him. I found two linear scars on the mastoid, the membrana tympani is sound and has good light spot, and is of good color. H D $\frac{20}{48}$; A C better than B C.

The peculiar interest in the case is found in Dr. Pulling's account of the subsequent progress of the case and in the results of the ophthalmoscopic examinations which I made. Dr. Pulling writes: "After you last saw Willie he had meningitis, lasting four to five weeks. He took bromides in full doses with aconite and so forth, when the temperature rose. His condition gradually improved, and at the end of two months or more from the date of your last examination his health seemed quite well established. About this time, however, it was observed that his vision was becoming defective. The impairment of sight I assumed to

be due to constriction of the optic nerve from contraction of the tissues about it."

The patient now, March 2, 1877, has only perception of light in the right eye and $\frac{6}{200}$ on the left. Both optic papillæ are in a state of white atrophy. The lateral vessels have all disappeared from the right papilla.

It is no new observation to find basilar meningitis in the course of acute inflammation of the tissues of and adjacent to the temporal bone. Our attention has been called by Kipp, Andrews, and others to the usefulness of ophthalmic examinations in the course of diseases of the mastoid, but I think it very unusual for a patient to recover from a suppurative inflammation of the tympanum, with mastoid periostitis, to become blind from optic neuritis and subsequent atrophy.

I have now under observation in private practice three cases of mastoid disease, of which I will give an account.

CASE 15.—*Scarlet-fever ;. acute suppuration of the right middle ear ; pain in the head ; swelling and redness of the mastoid ; incision through the periosteum ; fistula found and enlarged ; still under treatment.*

Miss W., æt. fifteen. The patient was attacked by scarlet-fever on Nov. 3, 1886. On the 13th she was seized with a severe pain in the head and with pain in the ear. These pains continued for several days until the membrana tympani broke, when the pain was materially relieved.

The pain in the head continued, however, accompanied by a free purulent discharge from the auditory canal, until February 5th—about three months. I then saw her for the first time, and found the patient anæmic and evidently suffering. The right membrana tympani was nearly gone, and the tympanum velvety. The left drum-head was intact. No tenderness or redness of the mastoid. The hot douche was prescribed, and the ear kept clean. Four days after the patient had severe pains through the temples at the apex of the mastoid. Leeches were applied, and relief given for two or three days, but on Feb. 14th the pain reappeared. There was found to be considerable swelling and redness of the mastoid. At 5 P.M. the temperature was $101\frac{3}{4}°$.

An incision was made, the periosteum removed, and a fistula

found leading from above the middle of the process into the tympanum. Some pus came from this. This was enlarged with a drill. A tent and poultice applied. She began to improve the next day, and her condition at this writing, a little more than four weeks from the operation, is as follows: No headache, anæmia disappearing, scarcely any discharge from the tympanum, and a moderate suppuration passes through a drainage-tube inserted into the mouth of the fistula in the bone. Temperature normal. Patient goes out.

March 31st.—Fistula in bone has healed. Membrana tympani restored. H D, $\frac{5}{18}$.

CASE 16.—*Chronic suppuration of the middle ear; mastoid periostitis; openings down to the bone; enlargement of the fistula; patient still under treatment.*

H. B., æt. sixteen, was brought to me March 4, 1887, by Dr. W. H. Cummings, of Honesdale, Pa., on account of pain in the head, dizziness, and occasional swellings of the mastoid process.

The hearing distance on the right side is normal. The drumhead is cicatricial and intact. The left mastoid process is depressed, and has a minute opening, about which the tissues are boggy. A fine probe passed into it can with difficulty be made to enter the bone. The auditory canal was half filled with sanious pus. It was believed that the tympanum and mastoid were the seat of purulent inflammation, and that they were not well drained.

That day the patient was etherized at the Post-Graduate Hospital, a free incision was made down to the bone, the minute fistula enlarged with a drill and the gouge. The tissue of the mastoid was found to be very soft, and an opening into the tympanum about one fourth of an inch in diameter was easily made. A large quantity of cheesy, inspissated pus, as well as that of a fluid quality, was evacuated. The patient is steadily improving, has no headache or dizziness. Whether or not he will have a permanent fistula remains to be seen. The mastoid tissues have been previously opened several times down to the bone, but not into it, but for the first time thorough drainage has been secured.

CASE 17.—*Acute suppuration of the right tympanum; mastoid red, tender, and swelled; fistula found; enlarged; relief; still under observation.*

On March 1, 1887, I was asked by Dr. W. A. Dayton to see a

female child of six years with the following aural history: During the holidays she had the earache several times, generally in the night, with some regularity at about 1 A.M. These attacks continued at intervals until Feb. 22d, when they became more constant. Her pulse was then 115. Her tongue was coated, the skin dry. The tympanum discharged very moderately; the mastoid process became red, tender, and swelled. Leeches and poultices were applied with only partial relief.

On March 1st I examined the ear. I found the drum-head perforate, caseous pus lying upon its remains, the mastoid as above described. I advised an incision down to the bone, in the usual way. This was made by Dr. Dayton; no pus was found, but a small fistula was discovered about one fourth of an inch above the apex of the mastoid, with softening of the bone about. This was enlarged and a tent introduced.

March 2d.—The relief has been very great.

March 19th.—There has been no pain since the operation. The wound, previously syringed with weak carbolized water, has been tightly packed every day with a twelve-inch tent.

Granulations have sprung up in the wound rapidly; these have been trimmed away daily with curette and scissors. The use of a four-per-cent. solution of cocaine has rendered the treatment almost painless.

There has been no pus (from the beginning) save that which comes away on the tent. The child has been kept in bed, in a bright, sunshiny room, and allowed a generous diet, meats only prohibited.

In this case the inflammation has been rather plastic than suppurative, or predominantly of the former character.

CASE 18.—*Acute suppuration of the tympanum; severe pain; diplopia; mastoid opened; no pus; no fistula; recovery in four months; fistula closed in about a year.*

A. M., æt. forty-six, colored, June 25, 1885.

For five weeks this patient states that he has suffered from a purulent discharge from the left auditory canal. For much of this time he has suffered much pain. He now has a suppuration of the tympanum, and complains of severe pain.

Two leeches were applied to the tragus, and morphia was administered hypodermically at bedtime. Warm douche to the canal.

July 5th.—The patient has been very comfortable for a portion of the time, but he has had considerable pain ; referred to the left side of the head. Besides the hot douche, poultices have been applied about the ear at times. It has been necessary to give morphia every night. The discharge has been profuse. This evening his temperature is 101°.

July 6th.—The patient has homonymous diplopia, the left external rectus being paralyzed.

July 7th.—Diplopia and pain continued. At about 4 P.M. the mastoid was opened with a drill. Dr. Emerson operated, assisted by Dr. Roosa. No pus, no fistula were found. A tent was placed in the opening and a poultice applied.

July 9th.—The patient has had no pain since the operation. Paralysis of the external rectus continues. The examination with the ophthalmoscope detects no lesion of the fundus oculi.

July 11th.—Yesterday a free discharge of pus occurred from the mastoid cells. He also had pain in the head and back of the neck, lasting three or four hours. This is the first since the operation, and at 5 P.M. his temperature was much higher and his pulse more frequent than at any time since the operation. This morning he is sweating profusely. The discharge from the ear is abundant.

The patient was taken from the hospital for a time, but reappeared in a few days.

August 6th.—He is now up and about his room. His temperature from August 5th to the 12th ranged from normal in the morning to 104° in the afternoon.

The fistula in the bone is free, and the patient has no pain.

On August 20th the patient again left the hospital. He reported daily, and was readmitted in about a month. The granulations were removed from the sinus by a curette, and the opening kept free. On October 14th he was discharged, without pain ; the diplopia disappeared. Some thirty days since, the fistula still existed. The patient made a perfect recovery, and is still living. The fistula closed ; abscesses occurred in the neck.

In another case, alluded to in this paper and fully reported in these ARCHIVES, vol. xii., 1883, diplopia also occurred during the course of erysipelas, which supervened upon the operation of opening the mastoid. It is remarkable that no pus was found on opening the mastoid. It soon, how-

ever, made its way through, and the fistula thoroughly drained the tympanum, and thus gave relief, and recovery ensued. I can but think that a fatal result might have ensued had not the mastoid been opened.

CASE 19.—*Acute suppurative inflammation of the tympanum; healing of the drum-head in two weeks; mastoid abscess; removing of pus; opening of mastoid; subsequently, deep abscesses of the neck; recovery.*

C. P., æt. twenty-three. Patient was admitted to the hospital on Sept. 3, 1886, and gave the following history:

Three months previously he had an acute suppuration of the left tympanum. The drum-head is said to have healed in two weeks. After this he suffered from severe headaches from the occiput around to the frontal region. A swelling behind the ear occurred a month ago, and since that time he has not suffered much from pain. The mastoid region is found to be swollen, but not red or tender. His hearing distance is $\frac{30}{40}$, and the membrana tympani is intact. The neck is also swollen down to the clavicle. On Sept. 26th Dr. Emerson opened the mastoid cells with a drill. Pus was found in the cells. A tent and poultice were applied In four days the great swelling of the neck had subsided, and pus was freely discharging from the opening in the bone. The patient is anæmic and feeble. Whiskey and iron and milk are given. The swelling of the neck reappeared and became greater than before the operation. An incision along the sterno-cleido-mastoid was made by Dr. Roosa on October 17th, and a careful dissection made under the muscle, and a large quantity of pus evacuated. Iodoform dressing was applied and a rubber drainage-tube introduced. An exploratory incision made some days before failed to find pus, but the operation of to-day showed that it has been burrowing for a long time. From this time the patient began to recover, and was discharged from the hospital on Dec. 10th with one drainage-tube leading down *to* the bone but not in it. For a long time previously the patient had three drainage-tubes—one into the fistula of the mastoid, one along the side of the sterno-cleido-mastoid, and one over the border of the occipital bone. For some time they communicated with each other.

The marked feature in this case was the complete healing of the membrana tympani with almost complete restoration

of the hearing, while the disease went on in the mastoid bone and extended from there deep into the cervical tissue.

CASE 20.—*Acute suppuration of the middle ear; mastoid; abscess; fistula; operation; relief.*

Bertha X., æt. thirteen, was brought to me by her father, a physician, Feb. 28, 1885, suffering intensely at times from pain referred to the left ear. The history states that she had severe pain in the ear on the Christmas day preceding, and that the ear had soon begun to discharge pus, and that it has continued to do so. The hearing distance is $\frac{c}{4\ 0}$. The bone-conduction is better than the aërial on that side. The drum-head is gone posteriorly, and there is a free discharge of pus from the tympanum. The mastoid region is red, swollen, and tender. The patient is of a delicate anæmic type.

On the same day the mastoid was incised, pus evacuated, a fistula leading into the tympanum was found and enlarged. A tent was applied. Relief to the pain soon followed. The patient was treated in the Manhattan Eye and Ear Hospital for some three months. The bone about the fistula was found exposed. The fistula was enlarged with a drill at the time of the operation, and kept open by the use of the curette; granulations sprang up very readily.

Feb. 23, 1887.—The patient is still under observation. The fistula has not yet healed, and pus discharges from both the auditory canal and the mastoid, but granulations do not form. The patient's general condition is decidedly better.

The prominent feature in this case is the fact that the fistula had not healed in one year after the operation. This may be due to two causes: 1, the delicate health of the patient; 2, the care of the patient at home—that is, in regard to keeping the fistula and tympanum clear—has not been quite as thorough as when the patient was under daily treatment at the hospital. To keep a fistula free from granulations often causes so much pain that a tender parent, even if a physician, will not always do it.

CASE 21.—*Acute suppuration of the middle ear; thickening of the tissues over the mastoid; no tenderness or pain; recovery without operation.*

Mrs. H., æt. thirty-three, was brought to my office on June 11,

1886, by Dr. John C. Peters, who desired my opinion as to treatment of her ear. The patient stated that some twelve weeks before, she was seized with a pain in the right ear. After using the nasal douche there was soon a discharge of pus from the auditory canal, which has continued ever since. The hearing distance on the right side is $\frac{P}{4\,8}$; on the left, $\frac{4\,8}{4\,8}$. At times she has considerable pain in the ear and the right side of the head. The tissues over the mastoid process were considerably thickened, but there was no redness, swelling, or tenderness. The drum-head was perforate, about half of the membrane being gone, and there was a free but not excessive discharge of muco-pus. The patient, who was a well-developed woman, appeared to be in a high state of nervous excitement. She stated that she had been under the care of several physicians, and that this morning the last one whom she had consulted advised that the mastoid be opened to-day; another had said she had syphilis, and so forth. Before she had made the statement in regard to an operation, I had advised Dr. Peters that his patient be kept in her room and that the ear be treated by the use of the warm douche and poultices, the latter in case of pain. After the statement as to the urgent need of an operation I again went over the case, but in view of all the symptoms I concluded that the drainage of the tympanum was sufficient, and that what was now needed was absolute mental and bodily quiet. The patient was treated in the manner indicated, leeches were applied to the tragus the next day, and poultices were used in front and behind the ear. The temperature remained normal, and while she was under my observation, some ten days, she steadily improved, and finally became well as to her general health and had no pain referred to her ear. There remained an opening of the membrana tympani when she was last seen by me and a slight muco-purulent discharge, but I have been informed by her mother, within a few days of writing this, that the patient, now nine months since, is perfectly well.

In this case, the patient's natural disposition and undisciplined mind led her to exaggerate her symptoms, especially as regards pain. Then again she has kept herself in a state of excitement by running about to various physicians, when the actual objective conditions were really not at all grave. At any rate, I felt that with a tympanum well open, a mastoid scarcely tender on the very firmest pressure upon

the apex, with no fever, and a brief history of aural disease, in a person excited by her frequent change in advisers, that delay was certainly proper. Much as I advise opening the mastoid when the indications are even moderately plain, and the conditions are urgent, I am always very anxious not to perform an unnecessary operation. The case belongs to the same class as that reported in full in this paper, Case 13, and the one reported in the ARCHIVES, and before alluded to in this article, where neurotic symptoms predominated over the inflammatory. I ought to add that after a thorough examination, neither Dr. Peters nor myself thought the patient had syphilis.

I have not been able, without unduly lengthening this paper, to give the details of all the interesting cases which I have not before published, but enough certainly are furnished, with the contributions of other writers, to vindicate, if vindication be necessary, the performance of Wilde's incision and, in case of need, of making opening into the mastoid cells.

If operative procedures are necessary for the drainage of the tympanum, certainly as a rule, they are best and most safely performed through the mastoid cells. In some instances these may be best reached, however, by an opening in the auditory canal. Such an operation as this, however, is not to be confounded with operations which aim to remove the remains of the drum-head and the contents of the tympanum. The latter, in my opinion, are dangerous and insufficient procedures, that have no advantages in the treatment of intractable chronic suppuration of the middle ear over perforation of the mastoid. Besides, the removal of the ossicles, and so forth, must be exceedingly difficult on account of the narrowness of the field of operation and the difficulty of knowing just what one is doing.

All of us know that even the operations for the removal of granulations deeply seated in the tympanum, become very difficult on account of the free bleeding, which soon renders all exact and delicate manipulation almost impossible.

Table Showing the Relative Frequency of Affections of the Mastoid in certain Eye and Ear Hospitals, and in the writer's private practice.

Name of institution.	Total No. of aural cases.	No. of years.	Affections of the mastoid.	Operations.
Manhattan Eye and Ear Hospital.	14,720	17	110	Wilde's incisions and opening of mastoid, 105. (Wilde's incision, 94. Enlargement of a fistula, 5. Perforation, 6.) One opening through auditory canal.
Brooklyn Eye and Ear Hospital.	18,366	18	91	126 Wilde's incisions and perforations of the mastoid.
New York Ophthalmic and Aural Institute.	14,634	17	112	Wilde's incisions, 108. Perforations of the mastoid, 22. Opening through auditory canal, 1. Total, 131.
Massachusetts Charitable Eye and Ear Infirmary.	9,533	3	62	Operations not fully recorded.
Newark Charitable Eye and Ear Infirmary.	3,021	3	22	15
Illinois Eye and Ear Infirmary.	2,464	4	8	16
New York Charity Hospital.	20	1	1	1
Author's Private Practice.	5,797	22	59	42

Percentage of Affections of the Mastoid.

Aural cases.	Mastoid cases.	Per cent.
14,720	109	.74
18,366	91	.49
14,634	112	.76
9,533	62	.65
3,021	22	.72
2,464	8	.32
20	1	.05
5,797	59	1.01
68,555	464	.67

Aural Cases Observed in Private Practice in

No.	Age.	Sex.	Form of original disease.	Treatment.
1	56	Male.	Acute suppuration of the middle ear.	Wilde's incision. Poultices.
2	55 about	Male.	Nasal polypus ; removal ; use of nasal douche ; acute catarrh of the middle ear.	Leeches. Poultices.
3	50	Male.	Chronic suppuration, middle ear, of four months' standing.	Wilde's incision. Pus evacuated.
4	30	Female.	Acute inflammation of the middle ear.	Warm douche. Poultices.
5	38	Female.	Acute inflammation of the middle ear.	Wilde's incision by Dr. Agnew. Pus evacuated.
6	30 about	Male.	Naso-pharyngeal catarrh ; use of nasal douche ; acute suppuration of middle ear.	Leeching. Poultices.
7	13	Female.	Chronic suppuration of middle ear.	Wilde's incision. Pus evacuated.
8	70	Male.	Chronic suppuration of middle ear.	Wilde's incision. Bone fistula found enlarged.

No.	Age.	Sex.	Disease exciting present attack.	Treatment.
9	30	Female.	Acute suppuration of middle ear.	Wilde's incision. No pus.
10	39	Male.	Primary mastoid periostitis.	Leeches.
11	3 mos.	Male.	Acute inflammation of middle ear.	Wilde's incision. No pus.
12	45 about	Male.	Sub-acute suppuration of middle ear.	Leeches.
13	26	Male.	Acute inflammation of middle ear.	Wilde's incision. No pus.
14	41	Male.	Acute suppuration of the middle ear.	Wilde's incision. Fistula found.
15	1 year	Female.	Chronic suppuration of middle ear.	Wilde's incision. Pus evacuated.
16	50	Female.	Chronic suppuration of middle ear. (Mastoid abscess, caries.)	Leeches. Hot douche.
17	27	Female.	Inflammation of external auditory canal.	Leeches. Wilde's incision.
18	60	Female.	Acute suppuration of the middle ear.	Wilde's incision. No pus.
19	21 mos.	Female.	Chronic suppuration of the middle ear from measles.	Wilde's incision. Pus evacuated.

[1] Cases in which the apex of the petrous bone was the chief seat of lesion, been excluded from this table.

which the Mastoid Process was Seriously Involved.[1]

Duration.	Result.	Remarks.
45 days.	Cure, membrana tympani headed.	Patient had an acute catarrh of the tympanum two weeks later, recovered under use of leeches in a few days.
60 days.	Cure.	Pyæmia occurred ; case reported, *Archives of Ophthalmology and Otology*, vol. i., p. 359.
4 days.	Was relieved when last seen.	Polypus also removed from canal.
3 days.	Cure.	
Unknown.	Cure.	Seen in consultation.
Some months.	Died in a few months. Death said to have resulted from disease of the brain.	Seen in consultation with Dr. Loring. Account of final result given to writer by Dr. J. W. Warner.
4 weeks.	Cure.	Drum-head did not heal. See author's text-book, p. 499.
4 months.	Cure.	Seen with Dr. Loring. Reported in author's text-book, 6th edition, p. 496.

Time under observation.	Result.	Remarks.
16 days.	Relieved.	Final result unknown.
1 day.	Unknown.	
A few days.	Died.	In consultation with Dr. Williams ; full account in body of the paper.
1 day.	Unknown.	
1 month.	Cure. Drum-head healed.	Mastoid periostitis occurred the sixteenth day after the ear was first affected.
Some months.	Cure. Bone fistula healed.	
1 day.	Unknown.	Seen with Dr. Jenkins, of Yonkers.
A few days.	Died.	Fully reported in body of article.
11 years.	Cure.	Still has eczema of the auditory canal.
A few weeks.	Cure. Drum-head healed.	In consultation with Dr. O. J. Ward.
Some days.	Relief of acute symptoms.	

and those of cerebral abscess without serous symptoms in the mastoid, have

No.	Age.	Sex.	Disease exciting present attack.	Treatment.
20	26	Female.	Chronic suppuration of middle ear.	Wilde's incision and enlargement of fistula with a drill.
21	28	Female.	Chronic suppuration of middle ear.	Mastoid trephined by Dr. Mathewson.
22	42	Male.	Acute suppuration of middle ear.	Leeches. Wilde's incision. No pus.
23	15	Male.	Chronic suppuration of middle ear.	Wilde's incision. No pus.
24	9	Male.	Chronic suppuration of middle ear from scarlet-fever.	Removal of polypus.
25	47	Male.	Acute suppuration of middle ear.	Opening of mastoid with drill.
26	42	Male.	Acute catarrh of middle ear.	Paracentesis of membrana tympani. Wilde's incision. No pus.
27	33	Male.	Naso-pharyngeal catarrh; used nasal douche; acute suppuration of middle ear.	Wilde's incision. Dr. Chas. Phelps. Fistula found.
28	5	Female.	Chronic suppuration of middle ear; spontaneous opening of mastoid.	Enlargement of mastoid fistula. Necrosed bone removed.
29	28	Female, colored.	Exostosis, mastoid process; no other disease of the ear.	
30	21	Male.	Chronic suppuration, middle ear; fistula, mastoid.	Fistula enlarged. Granulations removed.
31	20	Male.	Chronic suppuration of middle ear.	Wilde's incision, and enlargement of fistula with drill.
32	30	Female.	Acute suppuration of middle ear.	Hot douche and poultices.
33	26	Male.	Acute suppuration of middle ear.	Leeches. Poultices. Warm douche.
34	5	Male.	Acute suppuration of middle ear.	Wilde's incision. Fistula found.
35	7	Male.	Acute suppuration of middle ear.	Hot douche. Poultices.
36	19 mos.	Female.	Acute suppuration of middle ear, with facial paralysis.	Opening mastoid through external auditory canal.
37	38	Female.	Chronic non-suppurative inflammation of middle ear, with facial paralysis and periostitis of mastoid.	Mercury and iodide of potash.
38	19	Male.	Acute catarrhal inflammation of the middle ear.	Leeches. Poultices.
39	60	Female.	Chronic suppuration of middle ears since childhood.	Counter-irritation.
40	4	Female.	Acute suppuration of middle ears with mastoid; fistula and facial paralysis.	Enlargement of fistula. Removal of nearly the whole of the temporal bone.
41	35	Male.	Acute suppuration of middle ear.	Opening of mastoid cells with chisel.
42	36	Male.	Acute suppuration of middle ear.	Leeches. Poultices. Incisions in auditory canal.
43	7	Female.	Acute catarrh of middle ears; malarial poisoning.	Quinine internally. Poultices. Hot douche.

Time under observation.	Result.	Remarks.
2 years.	Cure. Drum-head did not heal.	Reported in author's text-book, page 521.
3 months.	Relief to pain for some time. Disease recurred.	Full account in body of article.
28 days.	Death from meningitis.	Reported in author's text-book, p. 310.
Several months.	Cure.	Patient now said to be dying of phthisis, some ten years later.
30 days.	Relief.	Mastoid had been previously perforated and healed.
1 year.	Cure.	Reported in author's text-book, p. 520.
Some months.	Cure.	Facial paralysis occurred. Reported in ARCHIVES OF OTOLOGY, vol. viii., page 355, and in author's treatise, page 321.
18 months.	Cure. Fistula remained open 18 months.	
3 years.	Cure.	
3 months.	Died of phthisis pulmonalis 3 months after.	Details in body of article.
8 days.	Died some months after of meningitis.	History given in full in body of this article.
3 days.	Relieved.	
1 month.	Cured.	
1 month.	Cured.	Dr. Dew performed the operation.
23 days.	Cured.	
8 weeks.	Cured.	Operation performed by Dr. Blake White.
33	Cured. (Facial paralysis remained when last seen.)	
20 days.	Cured. Drum-head healed.	Treated by Dr. J. B. Emerson.
4 months.	Cured. Drum-head healed.	
1 year.	Cured. Permanent fistula in bone.	Reported in full in ARCHIVES OF OTOLOGY, vol. xv.
2 weeks.	Cured.	In consultation with Dr. Gruening. Operation by Dr. Gruening.
6 months.	Relieved.	
3 months.	Cured. Drum-head healed.	

No.	Age.	Sex.	Disease exciting present attack.	Treatment.
44	13	Female.	Acute suppuration of middle ear.	Wilde's incision, with enlargement of fistula by drill.
45	6	Male.	Acute suppuration of middle ear.	Wilde's incision. Pus evacuated.
46	69	Male.	Bronchitis; acute catarrh; acute suppuration of middle ear.	Mastoid opened with drill.
47	25	Male.	Chronic suppuration of middle ear.	Opening of mastoid with drill.
48	21 mos.	Female.	Acute suppuration of middle ears.	Wilde's incision. Enlargement of fistula.
49	30	Female.	Acute suppuration of middle ear from use of nasal douche.	Warm douche. Poultices.
50	52	Male.	Inflammation of external auditory canal.	Warm douche.
51	25	Female.	Acute suppuration of middle ears.	Warm douche. Poultices.
52	43	Male.	Acute suppuration, right middle ear.	Warm douche. Poultices.
53	16	Female.	Neuralgia, middle ear.	Tonics. Change of air.
54	15	Female.	Acute suppuration of middle ear from scarlet-fever.	Wilde's incision. Fistula found and enlarged with drill.
55	16	Male.	Chronic suppuration of middle ear from scarlet-fever, with mastoid fistula.	Wilde's incision. Pus evacuated.
56	38	Male.	Sub-acute catarrh of middle ear.	Wilde's incision.
57	6	Female.	Acute catarrh of the middle ear.	Wilde's incision. Soft bone broken down with a probe.
58	3	Male.	Chronic suppuration of middle ear.	Wilde's incision. Fistula found and enlarged with drill.
59	4	Male.	Chronic suppuration, middle ears, from scarlet-fever; fistula in both mastoids.	Enlargement of fistula with drill.

[1] Since writing this paper I have received a note from this patient stating that

Time under observation.	Result.	Remarks.
2 years.	Relieved. Fistula still open.	Fuller report in body of article.
2 years.	Cured. Drum-head healed.	Meningitis. Atrophy of optic nerves. Fuller report in body of article.
1 month.	Died.	Full report in body of article.
15 days.	Died.	Fully reported in body of article.
1 year.	Cured.	
6 months.	Cured.	Fully reported in body of article.
1 month.	Cured.	
2 months.	Cured.	
1	Unknown.	Started for San Francisco next day.[1]
1 month.	Cured.	
50 days.	Relieved.	Under treatment. Membrana tympana healed.
17 days.	Relieved.	Still under treatment.
1 month.	Died.	Reported fully in author's treatise, page 512.
20 days.	Relieved.	Operation by Dr. Dayton. Report in body of article.
13 days.	Died.	Full report in body of article.
1 month.	Relieved.	

he is well. This reduces the number of results unknown to three.

Statistics of Cases of Disease of the Mastoid in the

No.	Age.	Sex.	Disease exciting present attack.	Treatment.
1	12	Female.	Subacute catarrh of middle ear.	Wilde's incision. Pus evacuated.
2	36	Female.	Chronic suppuration of middle ear.	Wilde's incision. Knife went through with mastoid cell.
3	18	Male.	Chronic suppuration of middle ear.	Wilde's incision. Pus evacuated.
4	6	Male.	Fistula of the mastoid.	
5	9 mos.	Male.	Chronic suppuration of middle ears; polypus; abscess of mastoid.	Enlargement of opening.
6	6	Female.	Acute suppuration of middle ear; small fistula in mastoid.	Enlarged with a drill.
7	5	Male.	Chronic suppuration of middle ear.	Enlarged with a drill.
8	2	Male.	Primary inflammation of the mastoid.	Wilde's incision. No pus.
9	6	Male.	Acute suppuration of middle ear with mastoid periostitis.	
10	2	Female.	Chronic suppuration of middle ear with mastoid fistula.	
11	48	Male.	Acute suppuration of middle ear.	Opening of the mastoid with drill. No pus.
12	20	Male.	Acute suppuration of middle ear.	Wilde's incision. Enlargement of fistula with drill.
13		Male.	Acute suppuration of middle ear.	Wilde's incision. Pus evacuated. Small fistula found, which was enlarged with drill.
14	17	Male.	Chronic suppuration of middle ear.	Wilde's incision. Evacuation of pus.
15	9	Male.	Chronic suppuration of middle ear.	Wilde's incision. Fistula in mastoid. Enlarged with drill.
16	23	Male.	Acute catarrh of middle ear.	Wilde's incision. Enlargement of fistula with drill.
17	39	Male.	Impacted cerumen with mastoid periostitis.	Leeches.
18	15	Male.	Acute suppuration of middle ear.	Wilde's incision. Evacuation of pus.
19	31	Male.	Chronic catarrh of middle ears.	Wilde's incision.
20	58	Male.	Chronic suppuration of middle ears.	Wilde's incision.
21	10	Male.	Chronic suppuration of middle ear with polypus.	Wilde's incision. No pus.
22	39	Female.	Acute inflammation of middle ear.	Leeches.

Writer's Service at the Manhattan Eye and Ear Hospital.

Time under observation.	Result.	Remarks.
	Unknown.	
2 weeks.	Relieved.	Deafness, with tinnitus aurium, and occasional stinging pains in the ears, appeared 4 months ago; has had no good sleep, until the operation, for 3 weeks.
	Relieved.	
	Relief.	
40 days.	Cured.	
	Unknown.	Drum-head normal.
18 months.	Cured.	Case reported in full in body of the article.
3 months.	Cured.	Case reported in full in body of the article.
	Relieved.	
3 months.	Cured.	Operation by Dr. Ramsdell.
7 months.	Cured.	
1 month.	Cured.	
1 week.	Relieved.	

No.	Age.	Sex.	Disease exciting present attack.	Treatment
23	54	Male.	Chronic suppuration of middle ear.	Mastoid opened with a drill.
24	4	Male.	Mastoid periostitis.	Leeches.
25	35	Male.	Chronic suppuration of middle ear.	Wilde's incision. Removal of necrosed bone through auditory canal.
26	48	Male.	Chronic suppuration of middle ear.	Opening of mastoid with drill.
27	24	Male.	Acute suppuration of middle ear.	Incision in auditory canal, and Wilde's incision. Pus removed.
28	30	Male.	Chronic suppuration of middle ear.	Wilde's incision. No acct. pus.
29	22	Female.	Acute suppuration of both middle ears. Mastoid periostitis.	Leeches. Poultices.
30	37	Male.	Sub-acute suppuration of middle ear.	Perforation of mastoid with drill. No pus.
31	15	Male.	Chronic suppuration of both middle ears.	Opening of mastoid with a thick probe.
32	43	Male.	Acute suppuration of middle ears.	Opening of mastoid with a drill.
33	5	Female.	Chronic suppuration, with mastoid fistula.	Enlargement of fistula.
34	2	Female.	Mastoid periostitis.	Mastoid opened through wall of auditory canal.

Historical Sketch of Operations upon the Mastoid Process.

It is only three years less than a century, since a Danish surgeon, Berger, of Copenhagen, who evidently suffered from chronic non-suppurative inflammation of the tympanum, or from disease of the labyrinth, misled by the indications laid down by the surgeons of his time, died from meningitis induced by an operation for perforation of the mastoid process. "A martyr to the operation," says one of the writers of his day. Beck (Handbuch, p. 60) states that Berger was old and deaf, and that after the bone was opened injections would not pass through the opening into the nose or mouth. Fever, sleeplessness, vomiting, and delirium followed, and the patient died in eleven days. There

Time under observation.	Result.	Remarks.
Some weeks.	Cured.	Reported in author's text-book, page 512.
3 months.	Cured.	Erysipelas occurred. Operation by Dr. Tilden Brown. Reported in ARCHIVES OF OTOLOGY, vol. xii., 1883; also in author's text-book, page 522.
3 months.	Cured.	Abscesses of neck, reported in author's text-book, page 525.
15 days.	Cured.	Reported in author's text-book, page 498.
2 months.	Cured.	
51 days.	Died of pyæmia.	
3 months.	Cure.	Patient had pyæmia. Fully reported in vol. x., ARCHIVES OF OTOLOGY, page 41; also in author's text-book, page 544, sixth edition.
2 months.	Cure. Drum-head healed.	Erysipelas occurred.
6 months.	Cured. Drum-membrane did not heal.	
2 weeks.	Cured.	

was suppurative meningitis. Where the bone was opened it was two lines in thickness, while the perforator entered for five lines.

Like perforation of the membrana tympani, trephining the mastoid, having been successfully performed under proper indications, was widely recommended for cases for which it could do but harm, and poor Berger's life paid the penalty for a want of knowledge on the part of the surgical writers of his day. If the operation had been performed many times, in such cases as those of Dr. Berger's, there would have been many more martyrs.

A regimental surgeon, Jasser, in 1776, performed the operation upon the ear of a soldier who had suffered long

from a chronic suppuration with occasional acute attacks attended by great pain. The mastoid was swelled; the patient was half insane with pain. Jasser made an incision on the mastoid about an inch long and found a drop of pus. Encouraged by this, he cut down upon the whole length of the mastoid bone. He found the surface roughened. With a probe he went quite deeply into the mastoid cells. He injected fluid into the opening; it came out of the nose, and, at the same time, a large quantity of pus was discharged from the external meatus. The patient immediately exclaimed that the pain had left his ears. He went quickly to sleep and rested uninterruptedly for ten hours. In three weeks the opening behind the ear had healed, the discharge from the auditory canal had ceased, and the patient heard better than before. Stimulated by this, Jasser performed the same operation upon the same person, upon the other ear, from which there was no discharge, but in which the hearing was impaired. Here the hearing is said to have also been improved, although there was no caries of the bone. The operation got its name from Jasser, although, as every medical reader knows, it had been proposed by Riolanus more than a hundred years before Jasser's time, and Petit had opened a mastoid with a gouge and hammer in 1750. The first named had proposed the operation for deafness and tinnitus caused by stoppage of the Eustachian tube. Morgagni declaimed against the operation, not on good grounds, however, but because he supposed there was no opening of the mastoid cells into the tympanum. Petit, however, recommended the operation for caries and abscess of the mastoid. Jasser seems to have lost his head after his first properly performed and successful case, and he probably was the cause of the widely spread recommendations of this surgical procedure for all kinds of aural cases. If Jasser had rightly understood the indications for opening the mastoid—indications which were plain in his first case and which were not to be found in the second,—a valuable surgical procedure would not have been practically ignored by the profession for nearly fifty years. It required about this length of time before surgeons would "med-

dle with the mastoid." The operation was, however, occasionally performed by independent surgeons, when pus was evidently retained in the bone, but very few reports are found of these cases. Tröltsch [1] finds seven cases prior to 1858. In the operative surgery of Sir Charles Bell,[2] as early as 1812, he says: "We learn from this view of the subject how carefully we ought to attend to symptoms when there is disease of the ear, lest it should become irrevocably bad, and end in communicating the disease to the brain. We must bleed and purge and foment to allay the pain and inflammation if it be active, . . . and when we can ascertain that there is caries in the posterior angle of the bone, with danger of the confinement urging the progress of the diseased action to the brain, we have to apply the trephine and penetrate into the cells of the bone." But here, as in all the writings until our own generation, there is a notable absence of any careful account of the early symptoms of mastoid disease, no one would be able from these general descriptions to diagnosticate and successfully treat the early stages of the affection. Dieffenbach,[3] in 1848, utterly condemns the operation, and agrees with Itard in saying that it should be entirely abandoned. He believes that a carious process would be increased by opening the bone. As great a man as Sir William Wilde [4] evidently does not understand that the bone ought to be opened under certain circumstances. He alludes to artificial perforations of the process for the purpose of throwing injections into the middle ear, or to relieve deafness in cases where the Eustachian tube had been closed,—an operation, he continues, which has long since been exploded, not only as ineffectual but positively hazardous. Although he had given a name to an incision through the periosteum of the mastoid for the relief of periostitis of this part, and although he alludes to fistulas being formed in this bone in the course of chronic suppuration, he gives no sign that there might be cases in

[1] *Virchows' Archiv.*, 1861.

[2] "A System of Operative Surgery," first American edition.

[3] Troltsch's Lehr Buch Sechste Auplage, p. 499.

[4] Text-book, p. 363. English edition.

which it would be wise to go further than the periosteum and open the bone. Indeed, in many cases where Wilde's incision was performed, a little search would have found an opening that nature was trying to make." But the improper indications of "closing of the Eustachian tube, tinnitus aurium, deafness" were so confounded with the one proper one of retention of pus, that even Wilde could not separate them.

Toynbee had a very large experience in fatal cases of mastoid disease, and yet all he has to say upon the subject of the operation is: "Perforation of the mastoid process also suggests itself, and this operation may doubtless be performed in those cases, when the matter is pent up in the cavity of the ear, and is causing such urgent and serious symptoms as are likely, if not relieved, to terminate in death. I have never performed this operation, but I should not scruple to do so in a case in which the life of the patient was threatened."[1]

Good surgeons everywhere followed Wilde in his advocacy of a free and deep incision down to the bone. In this city, the late Professor Post regularly lectured upon affections of the mastoid, and often made Wilde's incision, but he also considered the operation of opening the process as one only or chiefly recommended for affections where it would be useless if not dangerous.

Prompted by a happy experience into which he entered rather timidly, Tröltsch in 1861 published a paper in *Virchow's Archives* upon the subject of perforations of the mastoid, which probably did more than any other one thing, to bring the subject clearly before the profession. He there reports a case in which he had in 1858, perforated the mastoid with a blunt probe. He collected the scattered cases from the literature of the subject, and seems to have been the first writer after Berger's martyrdom who was wise enough to show that opening an ulcerated mastoid to remove dead bone, concealed pus, and secure thorough drainage, was a proper and often necessary operation. According to Tröltsch's own words, although the indications

[1] "Disease of the Ear," London, 1860, p. 341.

would now be considered imperative and clear, he opened the softened mastoid with fear and trembling. He says: "I went to work with uncommon care, even with dread."

Tröltsch's case was one of those that I have found more frequently than any other—that is to say, one in which a fistula had been made in the bone by the suppuration process.

Tröltsch seems to have hesitated after making a Wilde's incision. He looked up the accessible literature of the subject, and he found some cases where life was apparently saved by the operation. All the authorities, however, were in doubt about the propriety of performing it, and he continues:

"What more natural than such an operation appeared to one who had scarcely practised medicine for a year, as an affair to be well weighed, and that I treated the case with great circumspection and almost in an experimental manner." "I think," he says, "if I had not achieved my end with a simple probe, then I would scarcely have desired to act more vigorously with other instruments." But Tröltsch had been a student of the great Irishman. He had often seen him divide a red, tender, painful, and swelled mastoid down to the bone, and he imitated him in this case, and, in spite of the authorities, in two days went further, when the pus escaped and relieved the sufferings of his patient.

In February, 1862, Lawrence Turnbull[1] published two cases in which he made an incision down to the bone, and a third in which two months after he had opened the external tissues, he perforated the surface of the bone with a sharp hollow probe, and applied nitrate of silver freely. A month later he again broke down a part of the bone, and nineteen days later he removed a large piece of bone, which was found to be movable with the probe, This was an operation very like that of Tröltsch, although the German surgeon only waited a few days, before venturing to go into the cells with a probe, while the American delayed for two months. In spite of its exclusion from some tables, Turnbull's case belongs to the same category with that of the

[1] *Philadelphia Medical and Surgical Reporter*, vol. vii., p. 463.

reviver of the operation. It was operated upon but three years after Tröltsch's case, and only one year after it was published.

In 1863 Pagenstecher[1] published two cases, with some remarks upon the nature of affections requiring the opening of the mastoid. He declares the technique of the operation to be simple and easily acquired. This is an article written in a truly surgical spirit. In 1868 James Hinton reported[2] a case in which he perforated the mastoid cells with a trochar, the next day after he had made an incision through the periosteum. The case was one of chronic suppuration of the tympanum. Mr. Hinton speaks of fourteen cases of perforation of the mastoid for the evacuating of matter reported by various authors. Twelve he says were successful. In one of the fatal ones pyæmia occurred. He says the operation is suitable to two classes of cases: 1. Those in which the matter collects in the dependent mastoid cells. 2. Those in which caries takes place in the roof of the pyramid. He recommends the centre of the mastoid for perforation in the former case, and in the latter the upper part of it, about on a level with the roof of the meatus. His recommendations are evidently inspired somewhat by Pagenstecher's paper.

In 1864 A. B. Crosby, living in the mountains of New Hampshire, probably not knowing of Tröltsch's writings, but perhaps having Sir Charles Bell's sound advice in mind, opened the mastoid, in three cases where he suspected the presence of pus, with a gimlet. Although this was in 1864, the cases did not get to general professional knowledge until 1873. Relief was given in all the cases. Some years after, in 1872, Dr. Agnew again opened one of these gimlet cases and found a sclerosed condition of the bone, one well known to the early writers.

By this time, 1864, the operation begins to be freely spoken of. Ludwig Mayer of Worms, Jacoby of Breslau, Follin, and others reported cases. Jacoby had a considerable experience, and wrote two or more valuable papers in the

[1] *Archiv für Kliniche Chirurgie*, Bd. iv., p. 322.

[2] *Times and Gazette*, London, vol. ii., p. 378.

Archives of Otology. He proposed instruments, gave tables, and so forth.

Schwartze of Halle, who has perhaps, performed the operation of opening the mastoid more frequently than any surgeon, first appears in the literature on this subject in 1864 (*Praktische Beitrage*, 1864), as having, some days after he had made a Wilde's incision, opened the roughened exposed bone with a probe, in the case of a child of 1¼ years old. The bone, he says, was very easily perforated. In August, 1869, he, with Koppe, reported a case of reflex epilepsy, with caries of the temporal bone, cured by an operative perforation of the mastoid process. He used a trephine.

In 1870 Agnew of this city, at a meeting of the American Ophthalmological Society, reported the case to which I have already alluded. At the same meeting I reported two cases in which I had opened the mastoid cells through a minute fistula, in each case with a stiff probe.

To those cases was added a history of the operation which I believe was the first complete account that appears in any language since the time of Berger. In this paper I attempted to lay down certain indications for the performance of the operation. After seventeen years of added experience I do not know that I can materially alter these rules, although I have somewhat amplified them.[1]

In 1873 A. H. Buck[2] began his writings upon the subject of opening the mastoid with a report of thirty-five cases occurring in various parts of the world, six of which are his own.

In the same year Schwartze and Eysell[3] published an historical account of opening the mastoid with a table of sixty-three cases, seventeen of which were from his own practice. This publication of cases he has continued until the present day.

Although it seems clear to most writers, that all these

[1] Transactions American Otological Society, 1870.

[2] These ARCHIVES.

[3] *Archiv für Ohrenheilkunde*, neue Folge, Bd., 1873.

steps have led to a point where we see that opening the mastoid process in many cases is a perfectly justifiable and a life-saving surgical procedure, the voice of specialists in this country is not quite unanimous upon the subject. The weight of authority seems to me, however, largely in favor of the operation, under the ordinary indications as laid down by the later writers. Strawbridge [1] said that he had seen over four thousand cases of purulent middle-ear disease in the last twelve years, and yet he had not trephined a single mastoid, nor had he seen a death, except in one child six months old, that died a few hours after he first saw the case. Dr. Theobald, *loc. cit.*, stated that his experience accorded with that of Dr. Strawbridge, although he had not seen so many cases. He had never opened the mastoid in the living subject. He had seen mastoid symptoms disappear under active constitutional treatment. These experiences, however, seem to stand by themselves. Nearly all of those who have seen many cases of aural disease have been obliged, occasionally at least, to open the mastoid. To me it seems as if the field of operation in this direction were likely to be enlarged rather than diminished. I have elsewhere [2] advised a thorough search for pus, and by an opening through the bone in all cases when seemed to be threatened from cerebral abscess. The only point in the subject that remains open for discussion seems to me to be the one pertaining to cases in which the only object is to secure better drainage of the tympanum, the mastoid itself being perhaps sound. No one with surgical education will deny that it should be opened when there is pus in it which has no sufficient outlet. No one on the other hand would consent to open it to fulfil such indications as those which deceived poor Berger.

I have said very little upon methods of operations, because I lay comparatively little stress upon them. Schwartze forsook the trephine at an early day and took up with chisels. In this he has many followers. I have continued to use a stiff probe and a drill. Buck continues to use the drill, while Crosby preferred a gimlet.

[1] Transactions American Otological Society, 1883.

[2] Treatise on the Ear, sixth edition, 1885, p. 553.

For many decades, aural surgery was almost exclusively in the hands of men who were endeavoring to cure the incurable, by injecting vapors and fluids through the Eustachian tube in cases of chronic non-suppurative inflammation of the tympanum. Their results were deplorably bad. Otology was in such bad repute that no one would meddle with the ear or investigate its curable affections.

Sir Astley Cooper, after benefiting one patient by a paracentesis of the drum-head, although he failed in all subsequent attempts, filled his waiting-room with the incurable deaf, whom he speedily drove out lest they should injure his reputation as a surgeon. Thus, in one way or another, aural surgery became a true *terra incognita*, about which the most absured tales got full audience, and in which very few capable and honest men labored. In these latter and better days the light of scientific and honest investigation has so cleared the pathways in Otology, that even if our footsteps vary here and there, we may walk in them with a fearless tread.

A CASE OF ACUTE INFLAMMATION OF THE MIDDLE EAR, INVOLVING THE MASTOID CELLS, WITH SPONTANEOUS PERFORATION OF THE MASTOID.

By DAVID WEBSTER, M.D.,

PROFESSOR OF OPHTHALMOLOGY IN THE NEW YORK POLICLINIC, SURGEON TO THE MANHATTAN EYE AND EAR HOSPITAL, NEW YORK.

Mary H. P., aged twenty-nine, widow, was referred to me on November 17, 1886, by my friend Dr. G. R. Bourke, of this city. The patient, a saleslady in a dry-goods store, said that her ears had always been well until about four weeks previously, when she caught a severe cold in the head. She had profuse discharge from the nostrils and a sore throat, and after this had continued for a few days she observed that whenever she performed the act of swallowing she felt a pain in the right ear. After a while the ear became "sore and painful to the touch," and the tenderness extended "back of the ear and up to the top of the head." It hurt her to brush her hair. She put hot glycerine into the ear one evening, and during the night she was awakened by a noise as of something bursting in her ear, and found that the ear was running.

She at once placed herself under the care of a homœopathic physician, who treated her with pills, and forbade the use of the syringe and of local applications, and continued under this treatment with no apparent benefit until she came under my observation.

Upon examination I found her left ear nearly normal. With her right ear she could hear my watch only when in contact with the auricle ($\frac{\text{contact}}{0\,0}$). The tuning-fork test showed that on the affected side, bone-conduction was better than aërial.

There was naso-pharyngeal catarrh with copious secretion. The

right external auditory canal contained pus, and pus was oozing from a small perforation in the red and swollen membrana tympani.

Inflation of the ear, by Valsalva's or by Politzer's method, forced pus and air through this perforation, and produced the easily recognized perforation whistle.

I cleaned the external auditory canal by gentle syringing with a warm solution of bicarbonate of soda, about a drachm to the pint, and having dried it with absorbent cotton, blew in some powdered boric acid through a quill powder-blower. I also directed the patient to use the warm douche, at home, if necessary for the relief of pain.

Nov. 19th.—The pain in and about the ear being worse, I directed the patient to have two leeches applied, one on the tragus and the other back of the ear.

Nov. 24th.—Notwithstanding leeching, douching, and anodynes, the pain and tenderness back of the ear have increased, and now, for the first time, there is considerable swelling of the tissues over the mastoid. There has been all along free discharge through the external auditory canal, and this remains unchecked.

As this condition of things seemed to point to the necessity of an early operation upon the mastoid, and as the patient's surroundings in her boarding house were such that, if operated upon there, she would lack the necessary care, I advised her to enter the Manhattan Eye and Ear Hospital. Accordingly, she did so on Nov. 26th. The next morning the swelling over the mastoid had increased; there was deep fluctuation on palpation, severe pain in and radiating from the mastoid, and a temperature of 100.5° F. As an operation now seemed to be urgently demanded, with the assistance of the House Surgeon, Dr. A. C. Rogers, the Assistant House Surgeon, Dr. R. L. Thomson, and Assistant Surgeon Dr. Frank W. Ring, I put the patient under ether and made an incision down to the mastoid about an inch in length and about half an inch from the attatchment of the auricle. Before the bone was reached pus began to escape. When the scalpel reached a point opposite to the external meatus, it came upon a fistulous opening through the bone communicating with the mastoid cells. Its point sank suddenly in about half an inch beyond the level of the external surface of the bone, and I hesitated to push it in as far as it would go, lest I might wound the brain. After completing the incision, however, a probe was passed in and

carious bone could be distinctly felt in the region of the mastoid cells. This was verified by each of the surgeons assisting.

A tent was then inserted to keep the wound open and insure free escape of pus. This tent was withdrawn twice daily, the cavity syringed out with a solution of the bichloride of mercury, 1 to 25,000, and a new one inserted. The external auditory canal was also douched with warm water twice daily, and having been carefully wiped out with absorbent cotton, was filled with boric acid.

Nov. 30th.—A rubber drainage tube was inserted into the bony fistula, and this, giving more satisfactory drainage than the piece of tape, was removed only once daily in order to make sure that there was no impediment to the free flow of pus.

Dec. 2d.—The mastoid region is looking better. There is still free discharge of pus from the fistula and from the external auditory canal.

Dec. 4th.—The patient's health has improved under a regulated diet with porter, and her bowels have been kept open by means of Seidlitz powders. The tenderness about the mastoid is markedly relieved ; also the swelling and redness are diminished.

Dec. 14th.—The patient has steadily continued to improve up to to-day, but now her temperature is a little higher.

Dec. 15th.—Temperature over 100°.

Dec. 16th.—Temperature again below 100°.

Dec. 18th.—Temperature normal. The patient showed no tendency to relapse from this time forward. The ear was occasionally inflated by Politzer's method.

Dec. 20th.—The fistula is healing from the bottom by granulation tissue and is crowding out the drainage tube.

Dec. 25th.—The drainage tube can no longer be used.

Jan. 7th, 1887.—The patient was discharged "cured." Back of the ear could be seen only the scar resulting from the healing of the incision. The perforation of the drum-head was healed about the same time, so that there was no longer any discharge from the external auditory canal. The hearing power was restored to $\frac{15}{16}$.

While under observation the temperature was taken twice a day—at 8 A.M. and 7 P.M. On the day she entered the hospital it was 100.5°, and at no time did it rise any higher. It ranged 100.5° to normal until Dec. 17th, a period of three weeks, after which it remained normal.

In this case the inflammation of the mastoid cells came about in the usual way. There was a severe "cold in the head" and an acute inflammation of the mucous membrane lining (the naso-pharnyx). This inflammation extended, by continuity, up the Eustachian tube, and thence into the mastoid cells, which constitute a part of the middle ear.

It is remarkable that there should have been sufficient penning up of the secretions in the mastoid cells to produce death of the bone and a large opening through its thick external wall in so short a time and without any apparent diminution of the discharge from the middle ear through the external auditory canal. It is also remarkable that after so severe and extensive an inflammation of the parts involved in the process of hearing so nearly the normal hearing power should have been restored.

FACIAL ERYSIPELAS OCCURRING AS A COMPLICATION OF DISEASE OF THE EAR.

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CASE 1.—Patrick M., Irish, æt. fifty-nine, was seen Jan. 9, 1882, suffering from a suppurative otitis media, which commenced Christmas night, when the left ear first pained him. He says there was a discharge in a few hours after the beginning of the attack, and this has continued ever since. He complains at present of tinnitus and some pain over the mastoid process. He has never had any ear trouble before, and is a strong and healthy man in appearance. He has bad teeth. The discharge is profuse and mucopurulent in character.

Jan. 27th.—The discharge during the past week has become less and on Jan. 25th, the anti-tragus became inflamed and swollen. An erysipelatous inflammation commenced to spread from that point, and yesterday, Jan. 26th, the whole auricle (left) became involved and is now twice the size of the right one. For three or four days he experienced considerable pain in the ear. The pains behind the auricle have become less ; the erysipelas now extends around the auricle, over the mastoid, and in front of the pinna. There are several granulations in the canal, which is filled with muco-pus, but less in quantity than when last seen ; the walls of the canal are very slightly congested, almost normal in appearance. The drum-membrane not well made out, as a polypus in the upper portion of the membrane obviates a good view. The erysipelatous inflammation extends upwards into the scalp ; tissues œdematous.

Jan. 28th.—The patient had a fairly good night. Inflammation about the auricle and mastoid somewhat less ; he says he had a chill last night and felt a little chilly this morning. He has

some slight fever ; pulse 100. The erysipelas is gradually extending over the scalp. The patient complains of being dizzy.

5 *p. m.*—Lower eyelids involved now and the erysipelatous blush extends over the forehead ; pupils of normal width and responsive to light.

Temp. 104.5° F. ; pulse 124. The patient's mind is clear and he has no headache. The discharge has been free all day and to-night the drum-head is less congested ; no applications made to the canal to-day.

Jan. 29th.—The patient had a good night.

Temp. 100.5° F. ; pulse 93, strong and bounding.

Left eyelid œdematous still, but the redness is disappearing about the face, forehead, and ear ; there is some œdema in the left infra-orbital region, also behind the auricle, which is still swollen but in a less degree. The scalp is tender and red over its greater extent and pits on pressure. The pains about the ear and mastoid region have almost gone ; the discharge is thick, muco-purulent but less in quantity. The membrana tympani is much less congested and the perforation is well seen in the posterior lower quadrant ; the neck is stiff and somewhat red.

8 *p.m.*—Temp. 102.5° F. ; pulse 102 ; no headache ; left pupil dilated, but responds to light.

Jan. 30th.—Temp. 100.5° F. ; the redness has disappeared from the face and is gradually subsiding over the scalp but has extended somewhat down the neck.

Jan. 31st.—Temp. 97.5° F. ; he had a good night ; erysipelas gradually subsiding ; membrana tympani clearing up and the discharge less.

Feb. 12th.—The discharge ceased about Feb. 2d and the noises about the same time. The watch is not heard on contact but he hears loud voice. The membrana tympani has healed ; lower half slightly congested and the epithelium is peeling off.

Mar. 13th.—Since Feb. 12th there has been some discharge, but when examined to-day the canal was found dry ; the membrana tympani is still slightly congested and lustreless but is clearing up. The hearing distance is almost normal.

Apr. 13th.—The hearing good ; his general health and appetite much improved. The drum-head is somewhat dull, and there is some congestion along the handle of the malleus and in Shrapnell's membrane.

In regard to the treatment adopted in this case, besides consti-

tutional measures and local applications for the erysipelas, the ear was treated with pulv. acid. borac. et hydrastis canad. before the appearance of the erysipelas and when it had fairly well subsided. The granulation was cauterized with nitrate of silver.

CASE 2.—A patient, German, æt. twenty-two, butler in a private family, consulted me Dec. 28, 1883, and said that a week ago the left ear began to pain him and to discharge. He had taken cold. The pain has been principally at night ; discharge slight. He has always been a healthy man ; he was troubled with boils on his arms and legs a few years ago, which the attending doctor told him were due to poor blood. When very small, he had some trouble with the same ear as affected now. Last night he was dizzy and nauseated and slept but little. Hearing distance, watch, R. E. normal ; L. E. $\frac{0}{60}$. A tuning-fork when placed on the vertex cranii is heard louder with the left ear.

Examination.—Right membrana tympani lustreless, retracted ; cone of light very small ; short process prominent.

Left canal almost occluded by a furuncle situated anteriorly in the cartilaginous portion of the meatus. Membrana tympani covered by sero-purulent fluid and pulsation in the lower part ; inner end of the canal slightly inflamed. Posterior cervical gland enlarged and hard, and there is some induration of the tissues in the ante-auricular region. The furuncle was opened and some pus evacuated. Temp. $102\frac{1}{2}^{\circ}$ F.; pulse 100.

Dec. 29th.—Temp. $102\frac{3}{5}^{\circ}$ F.; pulse 100. He slept better than for some time. The induration in front of the auricle is to-day more pronounced, and a gland at the angle of the jaw is indurated. L. *h.* $\frac{2}{60}$. There is a perforation in the posterior and lower part of the drum-head ; the discharge watery but not profuse ; no pain in the mastoid ; there is, however, an erysipelatous blush over the cheek, and indurated tissues in front of the auricle.

8 *p.m.*—Temp. $103\frac{1}{5}^{\circ}$ F.; pulse 105. The patient got up and was around for several hours, but felt dizzy on walking ; there is no pain in the ear, only in the indurated tissues.

Dec. 30th, 9:30 A.M.—He slept more during the night and feels better to-day. The erysipelas is beginning to spread, and besides involving the entire auricle, which is very much swollen, extends over the cheek and above and behind the ear. Temp. $102\frac{1}{5}^{\circ}$ F.; pulse 102. The *Mt* is less congested and looks better ; the discharge is a little more profuse and thicker ; the posterior inferior quadrant of the drum-head is destroyed. 7:30 P.M. temp. $104\frac{3}{5}^{\circ}$ F.; pulse 100.

Dec. 31st, 9:30 A.M.—Temp. $103\frac{3}{5}^{\circ}$ F.; pulse 100. The erysipelas is fading where it commenced, but is spreading towards the nose and on to the left side of the forehead; there is none however below the angle of the jaw; the inflammation has extended across the nose; the left auditory meatus is closed. 2 P.M.: temp. $104\frac{3}{5}^{\circ}$ F.; pulse 104. 8 P.M.: temp. $102\frac{4}{5}^{\circ}$; pulse 100. No delirium, no headache. The erysipelatous tissues are covered with vesicles.

Jan. 1st, 9:30 A.M.—The patient slept but little during the night, and was restless; discharge from the ear very slight; the erysipelas has involved the left eye and has now spread to the right one; 10 P.M. temp. $103\frac{2}{5}^{\circ}$; pulse 100.:

Jan. 2d.—He had two attacks of epistaxis since last evening. Right eye closed; left one commencing to open; the erysipelas has spread over the right cheek and has extended into the scalp. Temp. 104°; pulse 90.

Jan. 3d.—Temp. $102\frac{2}{5}^{\circ}$; pulse 96. He had a good night and seems better to-day; redness fading, and desquamation commencing; there is some tenderness and œdema on both sides of the head.

Jan. 4th.—Temp. 100°; pulse 78. The perforation is closing; some muco-purulent discharge in the canal. Right auricle swollen and tissues over the mastoid invaded; both eyes have opened, and face and forehead desquamating; the left auricle has regained its natural size; watch, L. E. 1″.

Jan. 5th.—Temp. $98\frac{1}{2}^{\circ}$; pulse 85 at noon.

Jan. 6th, 4:30 P.M.—He slept well last night and his appetite is improving. The soreness about the scalp is less. Urine examined; albuminous and diminished in quantity.

Jan. 9th.—The perforation in the *Mt* closing; there are no noises in the ear, nor have there been any at any time; urine free from albumen.

Jan. 14th.—The patient is about his work now, and the perforation is almost closed.

Besides constitutional treatment and local applications for the erysipelatous inflammation, the ear was treated by the so-called dry method, the insufflation of powders, principally boracic acid.

I reported these two cases at a meeting of the N. Y. Ophthalmological Society, and in the discussion which followed, Dr. Roosa mentioned two cases which are given at

length, in his treatise on the ear, in which erysipelas occurred as a complication of mastoid disease.

Dr. J. S. Prout spoke of a patient whom he had seen, Miss A. V. I——, æt. 40, Jan. 17, 1879. She had acute otitis med. dextra, following a cold and sore throat; *Mt* injected and pushed out. It was punctured, giving exit to bloody serous fluid. Later on the same day, two leeches were applied, with relief of pain. Jan. 19th, there was much pain, free discharge from the tympanic cavity; walls of the meatus (ext.) inflamed and they were incised up and down. There was a swelling in front of the tragus which was punctured but no pus escaped; the walls of the ext. meatus being still inflamed, were incised in three or four places, under partial influence of chloroform.

Jan. 21st.—Erysipelas set in extending across the face, later over the scalp, reaching the neighborhood of the left ear on the 24th. During this time a free discharge persisted from the right ear.

Feb. 2d.—Her condition in general and as to the right ear had decidedly improved, but the left ear then became painful with *Mt* giving a red reflex and pushed out by fluid; the drum-head was incised, giving exit to a small quantity of bloody fluid. In a week, the perforation in this ear was healed. The right ear continued to discharge for a few weeks longer, with a round perforation in lower posterior quadrant. In April, furuncles formed in this ear but were not incised.

Apr. 1887.—The perforation still persists, but the ears have given no further trouble.

Dr. St. John, of Hartford, had also had a patient in bad hygienic surroundings, for whom he had made an enucleation. Erysipelas attacked that side of the face and then went around to the other, and was followed by an otitis med. purulenta on this latter side.

At a subsequent meeting of the same society, Dr. David Webster reported the following case which he had seen a few days since. Mrs. N., of New York, æt. 69, in poor health since the middle of December, 1886, complained of vague pains in the head, which seemed to be gradually lo-

cated in the left ear, about the 12th of Feb., 1887. A discharge was first noticed from that ear. Considerable pain for the next two days was referred to that ear, together with general pains in the head, which she had had from the first, and they are still present. On Feb. 14th, in the morning, erysipelatous inflammation was first noticed on the left side of the nose and cheek, and it spread over to the right side of the nose and cheek, but never reached either auricle, never passed the angle of the face on the left side, where it spread the most. On the same day that the erysipelas first appeared, acute otitis media attacked the right ear, and a discharge followed on the night of the 15th. Under vigorous treatment for the erysipelas and the warm douche, the inflammation subsided in a couple of days, and the discharge from both ears ceased in three or four days. On the 18th, the middle-ear symptoms having begun to subside, the left auricle and ext. audit. canal became very much swollen (otitis externa) but there was no immediate connection between that and the facial erysipelas. It involved the canal very little, but the whole auricle was red, swollen, and sensitive. The patient is still troubled with neuralgic headache, although the erysipelas is well and the perforations of the drum-head have healed. The head pains are almost entirely of the nature of right hemicrania. The hearing has returned to the left ear, while with the right she can hear the watch only when in contact with the meatus.

Dr. D. C. Cocks also reported a case which he had recently seen, of erysipelas followed by otitis media purulenta.

According to some writers, erysipelas affecting the auricle may occur as a primary or idiopathic disease from cold and other causes, but more frequently it is due to an extension of the inflammation from parts adjacent to it. Leech bites sometimes cause erysipelatous inflammations as well as incisions made in the walls of the ext. audit. canal, in persons whose general health is not good. When the auricle is involved, the disease may spread to the auditory canal, completely occluding it and also causing an inflammation of the middle ear. On the strength of modern researches, it is now generally admitted that erysipelas is caused by bacterial in-

vasion of a wound, in all instances (Fehleisen's micrococcus erysipelatous). In both of my cases, the erysipelas was evidently secondary to the inflammation of the ear. The first patient had an attack of acute sup. otitis media on Christmas night, but was not seen by me till Jan. 9th. Two weeks later the antitragus became inflamed, and on the following day the whole auricle was involved in an erysipelatous inflammation and was twice its natural size, the auditory canal at the time being less congested and the discharge somewhat diminished in quantity. There was nothing in the appearance of the canal or middle ear, before the appearance of the erysipelas involving the auricle and face, to denote any thing but a severe case of suppurative otitis media.

The second patient, when first seen, was suffering from acute sup. otitis media and furuncle of the canal, which had commenced a week before; the inner end of the canal was but slightly inflamed, but there was induration of the tissues in the ante-auricular region. The furuncle was opened, and on the following day an erysipelatous inflammation commenced to involve the auricle.

In both patients, their general health being below par, the erysipelas was probably caused, in the first case, by the muco-pus, which, irritating and excoriating the parts, set up an inflammation of an erysipelatous type; while in the second case, the disease undoubtedly followed the opening of the furuncle in the cartilaginous meatus, as it is a well-known fact that, in debilitated persons, erysipelas may follow the most insignificant as well as the most violent injury.

It is also probable that erysipelas of the pharynx may spread to the face by means of the Eustachian tube, tympanum, and ext. auditory canal, for Morrell MacKenzie in his work on throat diseases, in speaking of an erysipelatous inflammation of the pharynx, says that the propagation of the malady from the face to the pharynx, and *vice versa*, was observed to take place by four different routes, viz.: (1) most frequently by the lips and mucous membrane of the mouth; (2) by the nasal fossæ; (3) by the Eustachian tube, the middle ear, and the ext. audit. meatus; and (4) by

the nasal fossæ, and lachrymal sac, and ducts to the conjunctiva and eyelids. In a case reported by Gull, the erysipelas, spreading from the pharynx, reached the face almost at the same time by the auditory and lachrymal channels. In one case seen by the same author, "the affection commenced in the auricle of the right ear and spread through the Eustachian tube to the uvula and left tonsil."

CASE OF CEREBRAL ABSCESS DUE TO EAR DISEASE, IN WHICH THE SKULL WAS TREPHINED BY DR. WM. MACEWEN, GLASGOW, WITH THE RESULT OF REACHING AND EVACUATING AN ABSCESS IN THE TEMPORO-SPHENOIDAL LOBE; COMPLETE RECOVERY.*

By THOMAS BARR, M.D.,

SURGEON TO GLASGOW EAR HOSPITAL; LECTURER ON AURAL SURGERY, ANDERSON'S COLLEGE, GLASGOW.

W. H., a boy, aged nine years, was admitted to the Ear Hospital on the 13th of January last. He is one of a large healthy family, and he had no previous illness, with the exception of whooping-cough. For about a year his mother noticed at times a slight, badly smelling discharge from the right ear. She was not aware how this discharge originated.

Three weeks before admission the boy was seized with pain in the affected ear and side of the head so severe as to prevent sleep, accompanied by a hot and dry skin, and followed in twenty-four hours by vomiting, with great drowsiness. These symptoms—the vomiting, the pain, and the drowsiness—continued for four days, during which the treatment consisted of the application of a mustard poultice to the stomach and the administration of a dose of senna. A doctor now saw the boy and prescribed poultices to the ear and powders for internal use. After four days the vomiting ceased, but the pain in the ear and head and the drowsiness still remained. A fly-blister was next applied to the skin behind the ear, and relief of the pain seemed to follow. A night or two after (about eight days from the commencement of the symptoms) he

* Dr. T. Barr, in sending in his MS., writes: "A portion of the report (that by Dr. Macewen) has already appeared in the *Lancet*, but the additional details given here, and the unusual importance of the case, would, I think, justify its insertion into the ARCHIVES." With this the editors heartily agree.—K.

had the first rigor, which was a severe one, lasting a quarter of an hour, during which "he shook all over and his teeth chattered and his feet were cold." Between this time and his admission to the institution he had, in all, six rigors, at intervals of about two days. He was drowsy, and frequently complained of pain in the ear and head. His bowels had been from the beginning obstinately confined.

Condition on Admission to Ear Hospital.—The boy had an extremely emaciated appearance, although he was before the illness and is naturally a plump boy. The face was somewhat livid. There was also a short, dry cough. During the first night he slept pretty well, and on the following day he looked better than on the one previous. The ear was now examined, and a perforation was found to exist in the upper part of the tympanic membrane, from which some purulent secretion was escaping, although the quantity was not great. There was defective hearing on that side, but the condition of the boy prevented an exact estimate of the degree of deafness.

For two days after admission there seemed to be a lull in the symptoms, no pain being complained of, although undue drowsiness was observed; after the two days, however, he began to complain of pain in the ear and head, and he had a slight rigor. There was no evidence of an acute inflammatory process or of retention of pus in the ear to account for the pain, and there was neither redness nor swelling over the mastoid process. Firm pressure, however, over the latter region elicited signs of pain, although evidently not of a severe character. The temperature at this time was 99.6°, and the pulse was 92. In view of the rigor and of the tenderness over the mastoid, I decided to perforate the mastoid process. Assisted by Dr. W. F. Somerville and Dr. F. V. Adams, I opened into the mastoid cells by chiselling through the cortex behind the external auditory canal, and succeeded in passing a stream of fluid (a weak, watery solution of carbolic acid) through the antrum and tympanic cavity, out by the external meatus, and also in the reverse direction. A small quantity of purulent and caseous débris was washed out. A drainage-tube was introduced into the orifice in the bone, and iodoform was used as a dressing. Twice a day afterward, a disinfecting solution was forced through from the opening behind to the external meatus, and *vice versa*.

The operation took place late on the Saturday evening, and for

two days no material change was noticed in the boy's condition. After that, however, a slight rigor occurred, the pain in the head became worse, and the drowsiness deepened. On the 18th a copious discharge, having a most offensive odor, suddenly began to escape from the ear. There is little doubt, from the suddenness of this discharge, that the contents of the abscess in the brain began at this time to escape partially into the ear; the odor of the discharge was quite the same as that afterwards emitted by the abscess in the brain when the skull was trephined.

On the 19th the condition was as follows: Frequent complaint of pain in forehead, which he wants to be constantly pressed with the hand. He is very drowsy, and during sleep the eyes are partially open. There is no appetite—refuses to take any food or drink. There is intolerance of light, and sticky mucus partially glues the eyelids together. The tongue is red and smooth; the pulse numbers 68, and the beats are somewhat intermittent; and the temperature is 100.6°. On the 20th, at 2 P.M., I made the following note: Temp., 99.6°; pulse, 70, and irregular. He frequently calls out: "Oh, my head; hold my head," and insists on the forehead being constantly pressed. Tapping over the right temporal region produced evident wincing. There is slight ptosis of the right eye. In moving the eyeballs there seems to be defective action of the left internal rectus. As he sleeps, the left eye is partially open. A flush of redness frequently suffuses the face. Dr. Finlayson, who saw the case on the evening of this day, notes: "Slight flabbiness of left cheek in movements. Moves both arms. No rigidity of neck. Abdomen retracted. No squint. No inequality of pupils. No diplopia, so far as can be ascertained." For the next two days he was very restless; seemed to suffer great pain in forehead, and refused to take any nourishment whatever; was emaciated as one in the last stage of phthisis, and seemed to be dying. On Saturday, the 22d, Dr. Gairdner saw the patient along with Dr. Barr in consultation, and they agreed that probably an abscess existed in the brain, and that Dr. Macewen should be called in, with the view of deciding on the propriety of operative interference. Dr. Macewen visited the patient the same evening, and was clear about the duty of trephining the skull in order to reach the abscess, which was probably in the temporo-sphenoidal lobe. The operation was performed the same evening at 10 o'clock.

The following is Dr. Macewen's description of the operation:

"On the thirtieth day of his illness Dr. Barr asked me to see a case in which he suspected cerebral abscess. The boy's state was then as follows: On approaching his bed one perceived a heavy fetid odor, traceable to the discharge from the right ear. One saw an extremely emaciated child, with a pale, grayish face, wrinkled skin, prominent cheek-bones, and somewhat sunken eyeballs. He lay in bed upon his right side, his hand beneath his head, looking as if he were asleep with his eyelids half open. His lips were livid, and on the upper one herpetic remains appeared. His tongue was red and dry. Sordes covered the teeth. When an attempt was made to rouse him, the right upper eyelid drooped, and there was a shade of passivity of the right side of the face, with a slight dragging of the angle of the mouth toward the left. The conjunctiva of the right eyelid was congested, and the lids were smeared with pus. The pupils were equal, about medium size, and responded sluggishly to the action of light. The veins over the right side of the head were congested and stood prominently out on his shaven head. Pain on percussion was elicited over the right temporal, while percussion over the head generally was calmly borne. There was no œdema about the mastoid process. The right sterno-mastoid muscle was rigid. There was no hard, cord-like feeling along the line of the internal jugular, though the external jugular was prominent. Acute pain was elicited on digital pressure just behind the origin of the sterno-mastoid, in the tissues near the exit of the vein which passes through the posterior condyloid foramen. He was in a state of stupor, from which he could only be partially aroused, and not to such an extent as to give an intelligent answer to any question. His pulse was markedly slow, 50 to 60 per minute, and was feeble and intermittent. His limbs were extremely attenuated, and there was an irregular muscular tremor over the body generally, such as one frequently finds in approaching dissolution. He had a frequent cough, with purulent expectoration, which had an offensive odor, and there were moist râles over both sides of the chest. His bowels were and had been obstinately constipated. His urine was free from albumen. It was somewhat difficult to believe that some weeks previously this boy was apparently stout and robust, and was vigorously engaged at playing football. There was a flow of excessively fetid fluid from the external ear, and as this was greater in amount than what would be likely to come from the antrum or middle ear, it was suspected that there

might be a connection between the middle ear and the intercranial cavity. There was no difficulty in concluding that this patient suffered from cerebral abscess, originating in septic otitis media. It was almost positive that it was situated in the temporosphenoidal lobe, and it probably had a tortuous and minute communication with the middle ear. It was feared that the lung affection was secondary to the septic absorption. The prognosis was almost hopeless, his youth being the one favorable point. Immediate operation was advised, and with Dr. Barr's concurrence it was at once carried out.

"**Operation.**—The middle ear was washed out with an antiseptic solution, and rendered as nearly aseptic as possible. The scalp and parts around the ear were carefully washed with soap and water, then they were cleansed with turpentine, and finally with methylated spirit. An anæsthetic was administered. A half-inch disc of bone was removed from the squamous portion of the temporal, at a point an inch and a half above and half an inch behind the centre of the external auditory meatus. The bone was normal; the dura mater was here slightly congested, and did not impart any brain impulse to the finger, neither was any discernible when the aperture in the skull was filled with fluid. When the membrane was opened and turned aside, the brain tissue immediately bulged into the osseous cavity and rose above its external level. The pia mater covering it was congested, and the brain substance had a yellowish-red appearance. A hollow needle was inserted into the brain in a direction which, if introduced far enough, would strike the eminence in the petrous bone above the middle ear. After it had penetrated the brain tissue for about three quarters of an inch, there was a sudden escape of foul gas, accompanied by a bubbling sound and the escape of a few bits of fluid. Evidently the upper part of an abscess cavity had been tapped, and this contained fetid gas. The needle was inserted a little further, when pus flowed out. It was of an ordinary yellowish color, and had an offensive odor. After two drachms had slowly welled away, the aperture in the brain tissue was enlarged by forceps, and portions of the brain tissue, which had become necrosed, were removed. The latter consisted of shreds, two about the size of a large horse-bean, the others that of barley grains. On their removal more pus welled away. The cavity was then washed out with a saturated solution of boracic acid. After that, however, there was still a slow oozing of pus,

along with the extrusion of minute shreds of brain tissue. It was evident that there was a considerable zone of purulent inflammation surrounding the abscess cavity, from which the pus continued to ooze. An aperture was then drilled into the base of the skull, just above the osseous boundary of the external auditory meatus, involving the squamo-petrosal suture. The dura mater was examined here, and found intact. It was penetrated, and the abscess cavity was reached. A stream of boracic lotion was passed from this aperture so as to wash out the cavity of the abscess, and it was continued until it passed freely out by the upper opening. The current was then reversed. Even after that, when the drainage-tube was inserted, an oozing of purulent fluid took place into the tube. The ear was again cleansed. Chromicized chicken-bone drainage-tubes were introduced into both apertures. The parts were thickly dusted over with boracic-acid powder, and dressed with sublimated wood-wool pads.

"When placed in bed the patient was extremely weak, but rallied after the first few hours. A marked improvement was observable during the first week. The pulse became quicker and the temperature a little higher, both good signs. The face became brighter, the eyes clearer, the eyelids free from pus, the ptosis vanished, and the mental condition improved. After the first week, though kept on restricted diet, he improved in flesh, and continued to do so at a rapid rate. The wounds were dressed about once a week, when the parts were thoroughly syringed with saturated boracic solution, the drainage-tubes being gradually curtailed, as the granulation tissue blocked them out. The softened brain tissue at the seat of the upper opening in the skull soon presented a mass of granulations, which increased in size and rose into the aperture in the bone, uniting with the layer which formed on the exterior of the skull. Soon the two became blended together, and cicatrization rapidly progressed. The chromicized chicken-bones answered admirably as drains, notwithstanding the action of the tissues, until they were renewed, the upper one after fully five weeks. They also presented the advantage over silver ones, of being easily shortened when required.

"The child put on flesh rapidly, and at the end of six weeks was quite plump."

Dr. Reid examined the eyes about the end of the fourth week after the operation, and could find no trace of optic neuritis. He was of opinion that optic neuritis could not have been present at

the time of the operation without having left some traces of its presence four weeks after.

On March 17th I examined the affected ear. There was still slight purulent secretion coming from the granulation tissue in the middle ear. The hearing power was as follows: A watch heard forty inches from the ear in normal hearing was audible at a distance of five inches and a half ($h=\frac{5\frac{1}{2}}{40}$). By bone-conduction hearing was very good. A tuning-fork (C) applied to the middle line of the head was heard louder in the affected ear. Pressed on the mastoid process, the tuning-fork was heard much louder than when held near to, but not touching, the orifice of the ear. The results of these tests with the tuning-fork pointed to a normal state of the labyrinthine and nerve structures.

A month after this the secreting process, under treatment by boracic-acid powder, was completely at an end, leaving behind a dry perforation. The boy was then in an excellent state of health in every respect. Mr. Rees Price, the dental surgeon, fitted over the aperture in the bone (the upper aperture, the lower being completely closed) a vulcanite shield, which serves very well to protect the part from injury. It is hoped that complete osseous closure will ultimately take place.

It remains to be noticed that Dr. W. F. Somerville made repeated and exhaustive analyses of the urine according to the method originated by Mr. A. E. Haswell, pathological chemist to the St. Joseph's Children's Hospital, Vienna. The following notes have been kindly furnished to me by Dr. Somerville:

"*Analysis made on morning of day of operation.*—This mainly indicates three facts: 1st. That a condition of fever is present, as judged from the small amount of urine excreted in 24 hours, its high color, acid reaction, and excessive specific gravity, the abundant elimination of urea, and extractive material (this latter comprising urophœin, uroërythrin, and indican). 2d. That a process of effusion is proceeding, as shown by the marked reduction of the chlorides. 3d. That great destruction of nervous tissue is going on, indicated by the large amount of phosphates present. This is the more striking when it is remembered that in febrile states generally the phosphates are decreased. Moreover the amount of earthy phosphates, the high specific gravity and acid reaction of the urine, the marked amount of indican and traces of carbonate of ammonia tend to raise suspicion that excessive changes in nervous tissue are occurring in the brain.

Analysis of urine passed from twelve to thirty-six hours after operation.—Contrasted with the last analysis, the fact that the urine is lighter in color, that the specific gravity is lower (though the gravity of fluid passed in twenty-four hours is diminished—from 0.41 L to 0.35 L), and that the extractive material is diminished indicates that the fever is not so acute. The increase of the chlorides relatively to the dry residue shows that effusion is not progressing so rapidly, whilst the marked diminution of phosphates points to a lessened metamorphosis of nervous tissue.

Analysis made seven days after operation.—The large quantity of urine, its light color, slight alkaline reaction, and low specific gravity lead to the conclusion that all fever is at an end. Chlorides have again increased in quantity, showing that effusion is steadily diminishing. That effusion, however, is still proceeding is shown by the fact that the total amount of chlorides excreted is yet subnormal. The phosphates are now only slightly in excess, and the destruction of nervous tissue must therefore nearly have ceased.

Analysis made thirteen days after operation.—The urine continues non-febrile in character. The chlorides relatively to the dry residue are now somewhat above the normal, indicating that exudation is at an end. The phosphates are relatively exactly normal, proving that no excessive changes in the nervous tissue can be proceeding.

No albumen was found in the urine at any stage of the disease, although tests were frequently applied.

REPORT ON THE PROGRESS OF OTOLOGY DURING THE LATTER HALF OF 1886.

I.—NORMAL AND PATHOLOGICAL ANATOMY, HISTOLOGY, AND PHYSIOLOGY OF THE EAR AND NASO-PHARYNGEAL CAVITY.

By A. BARTH, of Berlin.

Translated by Dr. Jefferson Bettman and Dr. Jas. A. Spalding.

ANATOMY.

a.—THE EAR.

1. A. v. Brunn, of Rostock. Demonstration of corrosion specimens of the ear. *Tagebl. d.* 59. *Vers. deutscher Naturforscher u. Aerzte*, Berlin, 1886, S. 138.

2. Dr. Guiseppe Gradenigo, of Padua. The embryonic relations of the ossicles and the tubo-tympanic cavity, and the morphological significance of the latter. A preliminary communication. *Centralbl. f. d. med. Wissensch.*, 1886, No. 35. Reprint.

3. Prof. E. Zuckerkandl, of Graz. A contribution to the comparative anatomy of the Eustachian tube. Three plates. *Arch. f. Ohrenheilk.*, Bd. xxxiii., S. 201.

4. Dr. Benno Baginsky. The development of the cochlea. *Sitz. d. physiolog. Gesellsch. of Berlin*, July 30, 1886.

5. Dr. Benno Baginsky. Development of the cochlea. Two plates. (Communications from the Anatomical Instit. of Berlin.) *Arch. f. microscop. Anat.*, Bd. xxviii., S. 1.

6. Arthur Boettcher. A retrospect of the more recent examinations of the structure of the cochlea in connection with

personal investigations. Two plates. *Arch. f. Ohrenheilk.*, Bd. xxiv., S. 1.

7. Dr. SIGMUND FREUD, docent of neurology in Vienna. The origin of the acoustic nerve. *Monatsschr. f. Ohrenheilk.*, etc., 1886, No. 8 u. 9.

8. Dr. GUISEPPE GRADENIGO, Jun., of Padua. The aural organ in leukæmia. *Arch. f. Ohrenheilk.*, Bd., xxiii., S. 242.

1. v. BRUNN demonstrated some corrosion specimens of the ear, obtained by using Wood's metal, macerated subsequently in a 5 % sol. of caustic potassa. He exhibited (1) casts of the ext. ear; (2) others of the external ear canal, of the tympanic cavity and labyrinth; (3) another specimen displayed a perfect cast of the mastoid antrum. The indestructible nature of the material employed, render these casts valuable for teaching purposes. Braune calls attention to a set of similar casts of the ear in the anatomical collection at Leipzig, prepared by Helferich. As the squama of the temporal bone is preserved in these, facilitating topography of the parts, he prefers the latter. Merkel recommends the use of celloidin in taking casts of the small cavities. Albrecht directs attention to the fact that the pneumatic cells of the temporal bone are rudimentary in human beings. In all probability (still noticeable in most apes) these extend along the zygoma and malar bone, and are in direct connection with the antrum of Highmore. The rudimentary state of these cavities in man will readily account for the variations in size and extent of the mastoid cells.

2. The following investigations were carried on in Prof. Schenk's laboratory. (1) The stapes of man, and of the higher developed mammals, is developed from two distinct and separate embryonic and morphological sources: (*a*) from the stapedial ring developed from the second branchial arch, and (*b*) from the lamina stapedialis (plate of the stapes), a part to be dissociated from the wall of the labyrinthian capsule. (2) At a period in which the osseous structures are merely indicated by fibres and heaping up of round cells, and, at a later stage, in which cartilage is already present, the point of origin of the stapedial artery from the carotid is different, and is attributed to an altered course of the latter. (3) The hammer and anvil constitute the proximal end of the mandibular cartilage. The handle of the hammer does not represent the proximal end of the first branchial arch, it being developed at a later period, corresponding

to that of the long and short process of the anvil. (4) The stapedial ring, developed from the second branchial arch, soon loses its relation to this structure and forms an intimate connection with the derivatives of the mandibular arch. (5) The tubo-tympanic space is originally developed from the first branchial fissure and the fissure formed by the inner wall of the two first branchial arches and the lateral wall of the base of the skull. It accordingly must not be regarded as a pouching of the intestinal tract. (6) The growth of the handle of the hammer in the direction of the auditory capsule produces a temporary closure of the upper segment of the tubo-tympanic cavity. (7) These developments can be followed comparatively throughout the entire series of mammalia. The stapes of amphibia and birds represents the lamina stapedialis of mammalia, while the columella corresponds to the annulus stapedialis with the anvil and hammer. The annulus stapedialis is homologous to hyo-mandibular of the fishes.

3. The Eustachian tube of the ORNITHORHYNCHUS PARADOXUS, instead of being tube-shaped, is represented by a simple fissure, which connects the tympanic cavity with the slightly pouched pharynx. In this respect it varies from other mammals, as all, so far as observation has shown, demonstrate a tube-shaped structure. Regarding the ventilating apparatus of the middle ear, this animal seems to be in closer connection with the amphibia, as the batrachia in general represent a similar condition. For further details consult the original.

4 and 5. The author publishes his investigations on rabbit embryos, and concludes that the stria vascularis is not composed of vascular epithelium, but of connective tissue, and that during the progressive development the epithelium at these points becomes so retrograded as to render its later identification very difficult. Further, that the supporting pillars are developed from two (Kölliker, Hensen), and not from one (Böttcher) cell ; that the endings of the inner cells are rounded, while the outer cells send fine filaments in the direction of the basilar membrane. The organ of Corti is directly connected with the cells of the large epithelial elevation by delicate prolongations. In other respects he confirms the observations of Böttcher, Hensen, Retzius, and Schwalbe.

6. BÖTTCHER censures a paper of Lavdowski, a German abstract of which differs from the Russian original by favoring Waldeyer in a controversy between Waldeyer and Böttcher.

He further reviews the publications of Nuel, Pritchard, the elaborate treatise of Retzius, both of Voltolini's articles, and Schwalbe's text-book. He finds fault with Voltolini's method of observation and the deductions based thereon. The reviewer's observations agree with Böttcher in his following views: "The vessels under consideration penetrate from the modiolus into the lamina spiralis, and are principally distributed to the periosteum of the upper lamella. In their course toward the edge of the lamina spiralis ossea, they take on a marked radiating direction. The majority of them form a series of loops within the limbus and return to the modiolus. Another portion of them pass between the two layers of the lamina spiralis ossea, form a series of loops within the nerve tissue distributed here, after sending a few communicating branches to the vessels above. The vascular loops contained within the limbus are mostly of considerable size, and running, as a rule, in a direction parallel with the sulcus spiralis, in their distribution on the surface of the limbus, appear to be arranged in layers parallel with the latter. These wide, spirally arranged loops are mainly noticeable in two places, *viz.*, in the tissues below the origin of Reissner's membrane, and more externally on the same level in the tissue near the sulcus spiralis. The loops, however, are also found in other portions of the limbus."

Böttcher recognizes but one vas spirale in the membrana basilaris always situated below the arches formed by the arcuate fibres. In various species of animals this structure is contained within the zona arcuata, its exact position, however, varying in each animal. Variations are also noticeable in the various periods of development. Its first appearance is observable at the period of the development of the scalæ; it must not be regarded as an offshoot of the system of vascular loops, but as a separate, newly-formed canal forming from below upwards. In embryos its lumen is wide, but in further development it contracts and flattens out in a vertical direction, at the same time becoming a cloud in the homogeneous layer of the membrana basilaris. The vas spirale contains a lymph sheath, noticeable in dogs and cats at the end of the embryonic period. As yet, no exact description of the terminal endings of the vas spirale at the apex and base of the cochlea can be attempted. Böttcher considers it as a capillary vessel, presenting no anastomoses outward (ligament. spirale) and but a few inward (lamina spiralis). Occasionally a capillary

loop passes through the labium spirale, and coursing for some distance along the habenula perforata, is mistaken for a second spiral vessel. At times there is a dichotomous division of the spiral vessel, the two branches, however, uniting again in its further course.

Böttcher never observed a third vas spirale. A continuation will follow.

7. This communication of a preliminary nature, to be followed by an elaborate treatise on the subject, treats of the examination of human fœtuses of from six to seven months. The results of Flechsig's new method of examination are as follows: (1) The fibrous masses of the central nervous system do not receive their medullary sheaths simultaneously, but according to a gradual well-defined succession. (2) The fibres which, in their course, in trophic and functional relations have been found to be connected with one another, receive their medullary sheaths at the same time. (3) The earlier development of this sheath is most marked in those bundles of fibres which radiate toward the periphery of the fibre region, while in the interior of this tract the central continuations and the layers of fibres which serve to unite the gray tissue are developed in a later period. (4) The medullated nerve-fibres show a contemporaneous development of the medullary sheath throughout their entire extent. Based upon these general observations, examinations of cross-sections gave the following results: Sections of the outer (anterior) nucleus of the acoustic nerve demonstrate a considerable development in its upper portion, and present a somewhat circular appearance toward its middle portion. This nucleus appears to be in intimate relation with the most inferior and external portions of the acoustic. As the characteristic appearance and staining of these fibres cannot be observed beyond the nucleus, it is taken for granted that they end here. Internally to this nucleus, a mass of fibres, the trapezoid body, extends beyond the median line and crosses with that of the opposite side. The trapezoid body is pierced by the acoustic, facial, and abducens nerves, and is in direct crossed relation with the upper olivary body.

8. Post-mortem examination of the ears of a man aged sixty-three, who died of leukæmia. The temporal bones are pale-yellow in color, osseous tissue very compact, the medulla purulently infiltrated. Both tympanic cavities are filled with a gelatinous

yellowish-red substance, which also extends into the mastoid cells. About a fortnight prior to his death, acute hemorrhagic otitis media had been diagnosed. Microscopic examination of this substance demonstrates new-formed connective tissue, interspersed with round and spindle-shaped cells and numerous blood-vessels. At several places, hemorrhagic extravasations are noticeable. Both labyrinths do not present the slightest trace of any leukæmic exudation. Even the most delicate structures of the membranous labyrinths were perfectly intact. Accordingly, it must be doubted whether the pigmented condition of these structures, so frequently described, bears any relation whatever to the leukæmic state. After a lengthy discussion the author concludes, that the case under observation, barring slight variations, in general presents a similar appearance to cases described heretofore, and that from a physio-pathological standpoint the aural complications of leukæmia are entirely different from the ocular.

b.—NASO-PHARYNX.

1. Dr. HABERMANN, docent of the German University at Prague. A contribution to the pathological anatomy of ozæna simplex or vera (studies from Prof. Chiari's patho-anatomical institute). Reprint from the *Zeitschr. f. Heilk.*, Bd. vii., 1886.

2. Dr. LOEWENBERG, of Paris. Priority in the discovery of the ozæna-coccus. *Deutsch. Med. Wochenschr.*, 1886, S. 446.

3. Dr. BAYER, of Brussels. The change of mucous polyps into malignant tumors. *Vers. deutsch. Naturforscher u. Aerzte*, Berlin, 1886. S. 398.

4. LÖWE. The function of the labyrinth of the ethmoid. *Ibid.*, S. 402.

5. SCHWABACH. The pharyngeal bursa. *Ibid.*, S. 400.

1. An exhaustive report of the paper read before the 59th congress of German scientists and physicians.

2. In reference to articles recently published by Thost and Klamann, LOEWENBERG claims priority in the discovery of the ozæna-coccus, and draws attention to his former publications on this subject.

3. BAYER demonstrates several specimens of nasal polypi, the apex of which was the seat of a papillary tumor. Microscopical examination showed it to be a villous cancer.

4. The author shows the distribution of the olfactory epithelium in cross-sections of rabbits' noses, according to the method generally practised. He further invites attention to Jacobsohn's organ, which is also lined with sensory epithelium.

5. SCHWABACH exhibited a large series of specimens attempting to disprove Tornwaldt's, resp. Luschka's view, that the bursa pharyngea is a sac-like appendage of the naso-pharyngeal space. He, on the contrary, agrees with Ganghofner, that it is merely a fissure of the mucous membrane which nowhere penetrates to any depth, the underlying basilar fibro-cartilage being everywhere unbroken in its extent. This fissure is not always present, and in isolated cases is represented by a dimple-like depression. This latter is morphologically identical with the termination of the central fissure, and is formed by the ridges of tissue separating the central from the lateral folds or reduplications of mucous membrane. Schwabach showed a number of specimens taken from adults, and demonstrated the cavity described by Tornwaldt as a bursa pharyngea to be nothing more or less than sections of a blind canal or tunnel formed by the agglutination or growing together of the two middle furrows. He, accordingly, is at variance with Tornwaldt regarding its independence as a separate formation, and regards it merely as a central fissure existing normally, and forming an integral portion of every pharyngeal tonsil. The embryological importance of this fissure will be treated of in a future publication. In answer, Tornwaldt claims to attribute no importance to the term bursa, and that he substantially agrees with Schwabach in his descriptions, but that he had only seldom seen the central depression which Schwabach declared to be a normal condition. Further investigation was needed to decide this question. Schwabach replies that it made an essential difference whether the bursa pharyngea was a normal structure present as such at birth, or a pathological formation. In the latter case it would be improper to speak of a catarrh or of cysts in it.

PHYSIOLOGY.

a.—ORGAN OF HEARING.

1. Dr. ADOLPH FICK, Wuerzburg. On the mechanism of the membrana tympani. *Verhand. d. Phys.-Medic. Ges. zu Wuerzburg*, N. F., Band xx., No. 5.

2. GELLÉ. On the rôle of the sensibility of the membrana

tympani in the orientation of sound. *La Semaine Médicale*, 1886, No. 42. (See also *M. f. O.*, 1886, 389.)

3. Dr. JOSEPH POLLAK, Vienna. On the function of the tensor tympani muscles. *Wiener med. Jahrbuch*, 1886, 555.

4. YVES DELAGE. On the function of the semicircular canals. *Compt. Rend.*, Tom. ciii., 749.

5. Dr. A. LUCAE, Berlin. Physiological and diagnostic contributions to otology. *Berlin. klin. Wochensch.*, 1886, No. 32.

6. Prof. HENSEN, Kiel. Graphic exhibition of vibrations of sound. *Zeitsch. f. Biologie*, Band xxiii., 291.

7. Dr. PAUL WENDELER. An attempt to represent graphically the vibratory curves of some consonants, and of other sounds, with Hensen's speech-writer. *Ibid.*, 303.

8. Dr. P. STARKE. On the measurement of the strength of vibrations. *Philosophische Studien.*, Band iii., 264.

9. Dr. ADOLPH LINDGREN. Consonance and dissonance. Studies in harmony. *Allgem. Musikzeitung*, 1886, 38.

1. The concavity of the *Mt* and the insertion of a stiff body (the handle of the hammer) into its tissue, contributes to make this structure of almost equal value for the reception of all conceivable varieties of sound. Artificial membranes resembling the *Mt* reflect tones of varying tint and pitch in proportion to their objective strength and entirely independent of the tension or size of the membrane itself. This is why the *Mt* has no predominant tone of its own. According to FICK, the organ of hearing must be regarded as a combination of two resonating apparatuses: one, the tympanum, constructed to receive the vibrations and to transmit them in an energetic form; the other, the cochlea, to make the various components of sound act in separate localities.

2. GELLÉ was enabled in various anæsthetic patients in Charcot's clinique to convince himself of the correctness of Hartmann's assertion that the *Mt* is of importance in the projection of impressions of hearing, and in the power of orientation. In one patient with total general anæsthesia, who felt neither mechanical nor thermic irritation, he demonstrated absolute loss of sensibility in both *Mtt* and meatuses. When this man closed his eyes he could not tell from which side a watch, whose ticking he plainly heard, was approaching toward the ear. Gellé also made the crucial contrary experiment in other anæsthetic patients;

whenever the individual could correctly tell the direction from which any given sound proceeded, the sensitiveness of the *Mt* could invariably be demonstrated.

3. POLLAK'S experiments start from the same point occupied by Stricker in his work on speech and song. Together with a detailed discussion of previous hypotheses, and the results of experiments in regard to the normal and pathological action of the *Mt*, the author gives in an extremely readable paper the following results of his own experiments in dogs: the tens. tymp. muscle always reacts on any moderately loud sound such as singing, whistling, tuning-fork, violin, etc. The needle attached to the muscle makes a decidedly more extensive excursion for higher tones than for lower. A certain intensity is necessary to produce the reaction, but the latter does not increase in proportion to the increase of the intensity. The pizzicato gives more precise results than an even stroking of the violin strings. These vibrations of the tensor muscle are to be regarded as a reflex action [analogous to the movements of the pupil, K.], for the waves of sound must first irritate the cochlea and the central nervous system, in order to react from the latter upon the motor nerve of the muscle.

The muscle ceased to react after destruction of both cochleæ, and after division of the medulla oblongata. The same observation was made in a deaf-mute dog. On the contrary, when only one ear perceives a sound, the muscle on the other side reacts also. The vocals cause the same reaction as musical tones, "a" being the most powerful, and "u" the least. The author therefore concludes that not man alone, as Stricker believes, but dogs also can distinguish various words by their characteristic clang-tint. He does not, however, attempt to answer whether or not the tensor muscle may have other duties to perform than those which he has so carefully described.

4. DELAGE follows Flourens, Goltz, Breuer, Mach, Cyon, and others in the opinion that the semicircular canals have absolutely nothing to do with hearing. He seems to be wholly unaware of the fact that this view has more than once experienced a great deal of opposition. His brief communication amounts to this: the semicircular canals are not the special organs for the sensation of locality; they do not represent to our perceptions the three dimensions of space; they do not give rise to reflex impressions as a result of audible impressions; they do not represent

any organ of special sense which always allows us whilst moving about in space to find again our original direction ; they only indirectly produce orientation in the position of the head by connection with the movements of the eyes. But their special role (a sensitive and excito-motor role) is at one and the same time to give us information in regard to the rotations of the head, and by reflex action to summon up compensatory motions in other muscles of the eyes, the head, etc., in order by their assistance to preserve equilibrium, and to assure security in the movements of the body.

5. LUCAE employs a short rubber tube with an inside diameter of 3 *mm*, which is pushed about ½ *cm* into the external meatus, and then weakly but with the greatest possible evenness inflated with the lips. This causes in the normal ear an objective and subjective noise with a fundamental tone approaching that of the small and once marked octave. This "insufflation-sound" owes its origin to the resonance in common, of the meatus, the *Mt*, and the middle ear. After removal of the *Mt*, it is of a lower pitch, but with a very firm *Mt*, or one that vibrates but little, it is higher ; it is also higher on stretching the *Mt* by Valsalva's experiment, or by contraction of the tensor tympani. Simultaneously with this latter experiment a patient who could voluntarily render his tensor tight, heard deeper tones much worse, whilst high or over-tones were apparently heard better than ever before. The sound was invariably high and whistling in those cases only, in which the examination with the probe showed that the *Mt* was either totally or excessively thickened, or considerably concave, or when the short process of the hammer or the posterior fold were extremely foreshortened, or finally when the middle ear was more or less filled with secretion. It was rare to find an increase in the pitch of the sound with simple opacifications in the *Mt* or with small calcareous concretions. The sound is rarely deepened in pitch if the *Mt* has ever suffered a solution of continuity, whilst this phenomenon is frequently noticed in cases of large and flabby cicatrices. All of these experiments consequently go to prove that depression, *i.e.*, relaxation of the *Mt* need not invariably be accompanied with disturbances of function, whilst on the contrary these are always found in elevations. In a practical and clinical point of view therefore Lucae *advises us to inflate the meatus as above suggested if we desire to decide accurately in regard to the tension of the Mt.*

6. HENSEN has no intention in his paper of accurately describing the "logograph" as schematically represented in its older form in Gruetzner's "Physiology of Speech," but simply to point out the principles upon which such an apparatus ought to be constructed. The receptive membrane should resemble the *Mt* as closely as possible; in order to obtain the most even writing for different pitches of tone, a heavy damper, a stiff membrane, and very minute writing are the essentials. The writing is to be done on a visible smoked glass-plate, and by means of delicate splinters of glass. Wendeler employs steel pens for this purpose. The greatest elongations rarely exceed 0.2 *mm*, and therefore the curves have to be rendered visible by means of a microscopic power of 300 to 400 diameters. We need not at this place enter into any further description of the apparatus employed by Wendeler and Hensen.

In opposition to Fick, emphasis is laid on the fact, that a longer writing-lever offers greater difficulties, and no advantages at all, in comparison with shorter ones.

7. STARKE shows that we are likely to learn a great deal concerning the laws of vibration, from the method of the graphic representation and permanent fixation of waves of sound. A careful study of the appended curves is necessary in order to understand the subject thoroughly. Thus, to cite a few examples, we may mention that the curves of the vowels are nearly pure, that the curves of the consonants in each word are combined with the curve of preceding and following vowel, that the letter R appears to show intermittent curves resembling a pseudo-vibration, that M, N, and L exhibit a vowel-like curve, that S and Ch offer mixed curves, and in the highest octaves show one thousand to fifteen hundred vibrations per second. When the artificial membrane is less tense the vibrations are undeniably more extensive, but they soon become quite indistinct. Hence if we stretch the sensitive receptive membrane we obtain an extremely advantageous representation of the vowel curves, whilst the consonants are shown off much more distinctly upon a slighly relaxed membrane.

8. It is impossible to tell precisely from the researches of previous observers, amongst whom Vierordt especially may be named, whether the vibratory motion communicated to the air is equal to the energy communicated to the apparatus, or at least proportional to that energy within certain limits. A portion of the reserved energy will of course invariably be transformed into

heat. According to Vierordt, the intensity of sound depends upon a power of the height of fall, so that for the intensity we have the formula $J = p h^e$ in which e is experimentally determined as equal to 0.6. Starke experimented with a ball held in position by an electro-magnet, and then let fall upon an ebony board by interrupting the current. On determining the exponent, he finds it to amount to 0.85, and 0.95, *i. e.*, always less than the unit. From this he concludes "that the intensity of sound is proportional to the *vis viva*." The reviewer of the *Naturw. Rundschau*, (1886, No. 31) thinks that this thesis can only be correct when by the *vis viva* we mean that of the excited movement of the air, for on the whole the intensity of sound depends in a complicated manner upon the way in which the vibrations are produced.

9. The author shows, at least so far as the piano-forte is concerned, that there are no undertones, but that on striking a note, the lower octaves, if not dampered, vibrate but partially, consequently in the same tone. On the whole, the reviewer, who is not musical, is inclined to think that the entire treatise is based more upon a philosophical and speculative foundation, than upon a physical or practical, so that those who are interested in the subject are referred to the original.

b.—NASO-PHARYNGEAL SPACE.

1. ARONSOHN. Experimental investigations into the physiology of smell. *Arch. f. Anat. und Phys.*, 1886, Heft iii. and iv.

2. HACK, W. Smell and the organ of smelling. A popular lecture. J. F. Bergmann, 1885.

3. HEUSNER. Dr. L. An observation on the course of the nerve of taste. *Berlin klin. Wochensch.*, 1886, p. 758.

4. R. H. FOX. The functions of the tonsils. *Jour. of Anat. and Physiology*, vol. xx., part 4, p. 559.

5. VULPIAN. On the origin of the motor nerves of the velum palati in dogs. *Compte. Rendu.*, Tom ciii., p. 671.

6. SCHADEWALT. On the localization of sensation in the cervical organs. 59.*te Versammlung Deutsch. Naturforsch.*, 1886, p. 400.

1. Weber's observation, that there is no sensation of smell when the olfactory membrane is brought into contact with a scented fluid, is easily explained by the fact that the water of the solution irritates the human mucous membrane too much to per-

mit the sensation to be excited. If the scented liquid is mixed with a 6-per-cent. solution of salt heated to 38° C., it can then be smelled for about thirty or forty seconds. The sensitiveness for oil of pinks and bromine was measured at $\frac{1}{10.000}$ *mg* in 1 *cm* of water. A sensation of smell is perceived, no matter whether the air passes through the nose from front to back, or *vice versa*. The sense of smell for a great many substances is generally blunted within a few minutes. After examining various scented stuffs, the author comes to the following conclusions: various qualities of smell affect various regions of the olfactory nerve in such a way that one class of odors excites one district to a maximum degree, a second to a less degree, and a third not at all. Finally the author attempts to prove that all the elements are odorless. Phosphorus, sulphur, chlorine, bromine, iodine, etc., form combinations in the air or in the nose with carbonic acid or hydrogen, and it is not until so combined that they excite a sensation of smell.

2. A patient, suffering probably from tuberculous disease of the base of the brain, complicated with an abscess, was observed to display paralysis of the first and second branches of the trigeminus, whilst the third branch, together with the facial nerve, was intact. In this case there was loss of sensation and taste on the tip of the tongue. An autopsy could not be obtained.

3. VULPIAN experimented on five dogs, exposing in the cranial cavity and irritating mechanically and electrically there the origins of the trigeminus, facial, auditory, glosso-pharyngeal, pneumogastric, and spinal-accessory nerves. He obtained the same results as Chaveau in the horse and ass. None of the motor fibres of the soft palate rise from the facial or trigeminus. The glosso-pharyngeus offers perhaps a few motor fibres for the Musculus staphylinus, yet irritation of this nerve produced motion only in the velum of a single dog. The real root for motor fibres of the soft palate is to be sought for in the inferior radicle-fibres of the pneumogastric and in the superior fibres of the spinal-accessory nerve. It is also quite possible that these fibres all belong to the spinal nerves or to the accessory of Willis.

4. The capacity for localizing sensations in the cervical organs is extremely defective. Almost every perception in these organs is generally located erroneously. Thus irritations in nearly all districts in this neighborhood (no matter whether in the posterior nares or in the naso-pharyngeal space, etc.), are usually re-

ferred to the anterior portion of the neck (laryngo-tracheal region). This peculiarity of the cervical organs finds its analogy in the urino-genital tract, and is the cause of various pathological sensations (paræsthesias) being referred to as a whole from the region of the posterior nares into the laryngeal and tracheal tract. This condition depends, therefore, upon an erroneous judgment of the place of irritation, and not upon any reflex action, as physiologists have so long assumed.

REVIEWS.

Text-Book of the Anatomy of the Organs of Special Sense. By Dr. G. SCHWALBE, Professor of Anatomy in the University of Strasburg. Second part, second half, with 52 wood-cuts. Published by E. Besold, Erlangen, 1886.

Reviewed by Professor S. MOOS.

We have already spoken of the first half of the second part of this text-book. The second half now lying before us worthily completes Professor Schwalbe's text-book of the anatomy of the organs of special sense—*Finis coronat opus.*

The literary references and the utilization which the author has made of the same extend to the middle of the year 1886, and as Professor Schwalbe has endeavored particularly to keep in mind the needs of the specialist in a practical point of view, our colleagues everywhere will obtain abundant instruction from a careful study of the present portion of the work.

After describing the nerves of the cochlea and their terminations, as well as the ductus and sacculus endolymphaticus, the vessels of the inner ear, its veins and lymphatics, the sound-conducting apparatus is next mentioned. (1) The ectodermal portion of the vibratory tube; the auricle and external meatus. (2) The *Mt.* (3) The *endodermal* portion; viz.: the tympanum, ossicles with their muscles, ligaments, and articulations, the mucous membrane of the tympanum, the antrum and mastoid cells, and the Eustachian tube. The work terminates with a review of the vessels and nerves of the middle ear.

The reader can easily see from the terms *ecto-* and *endo-dermal portions*, that the author has again followed the **ontogenetic** theory, and the result is that the representation and the study of the organs in question gain wonderfully in clearness and brilliancy. But the book must be studied, and for that very reason we shall

simply limit our notice to the brief mention of a few of the most important topics.

Schwalbe opposes L. Meyer, and ranks himself at the side of Lange and Darwin, so far as Darwin's "Protuberance" on the helix is concerned—*the Spina, sive Tuberculum Darwinii*—to which the latter's attention was called by the sculptor Woolner, and which appearing as it does in various mammals and also in apes, has been accounted for by the eminent evolutionist on the theory of "atavism."

The author asserts with Bezold, that the shape of the external meatus, as seen in numerous horizontal sections and casts, is on the whole like that of an "S."

All measurements of the cartilaginous and osseous meatus are started, in agreement with Bezold, at the anterior tragus plate, because he believes that this plate really belongs to the walls of the meatus. The consequence is, in opposition to v. Troeltsch who started his measurements from the posterior margin of the entrance of the external meatus, that in Schwalbe the cartilaginous meatus is longer than the osseous. According to Bezold, the proportion at the anterior and the inferior wall, is as 21.18 to 14.05.

Particular attention is paid to the anatomical relations of the external meatus: the **anterior** wall—according to Sappey, the temporo-maxillary—in its relations to the articulation of the inferior maxillary bone. The **inferior** wall—Sappey's parotid wall—lies throughout almost entirely in contact with the deep process of the parotid gland. The **superior** wall—the cranial wall of Sappey—is partly overtopped by the tympanum, particularly behind the mastoid antrum, and in the whole of its bony portion separated by a bony plate of $\frac{1}{8}$ *mm* thickness from the median cerebral fossa. The **posterior** wall—mastoid wall of Sappey—is only separated from the mastoid cells by a bony lamella $\frac{1}{2}$ *mm* thick. The transverse sinus of the posterior cerebral fossa is but 12 *mm* distant. The mastoideo-tympanal fissure is often seen in the latter in macerated specimens.

This section is followed by an account of the excessively different conditions of the meatus in the new-born, the development of the inferior, anterior, and of a portion of the posterior wall from the **annulus tympanicus**, the evolution of the os tympanicum, and its peculiarities, the defects in ossification, the relations of the lumen of the external meatus in infants, the finer structures of the cuticle of the meatus, vessels and nerves, the auricle and mastoid process and external meatus, and lastly the lymphatics.

Next we have, and, as I believe, more exhaustively treated than in any other text-book, a detailed description of the *Mt* in its anatomical, physiological, histological, and comparato-anatomical relations, as well as of its several layers, its blood-vessels, lymphatics, and nerves.

In regard to the **capillary meshwork** at the margin of the mucous layer (as set forth by Burnett and myself), or meshwork-like capillary vessels curving about upon themselves, the author is of the opinion, that these correspond to the shaggy or papular-like prominences of the mucous membrane discovered by Gerlach. Nevertheless, after renewed and repeated examination of my preparations, which are still in an excellent state of preservation, I cannot assent to this opinion, and all the less since the meshwork in question has also been noticed along the handle of the hammer. (See my paper on this topic in these ARCHIVES, vol. vi., pp. 582 and 594.

Under the section of the **endodermal portion of the sound-conducting apparatus** are described the tympanum, its form, topography, and walls, the ossicles, their articulations with one another and with the tympanic walls, and particularly the close connection of the hammer with the *Mt*, and of the stapes with the fenestra ovalis ; finally the ligaments and muscles of the ossicles, the mucous membrane of the tympanum, its bridges, folds, inlets, and pockets, as well as the finer structure of the tympanic mucous membrane, together with its blood-vessels, lymphatics, and nerves.

The account in this section of the separate walls of the tympanum, and of their topographical relations, is of especial value to the practising aurist.

In his statement of the development of the ossicles, the author narrates with especial accuracy that of the stapes, and amongst its rare varieties that of the so-called columella-formation. At this point I will go so far as to refer the cases described by Steinbruegge and myself under the titles of "On the combined occurrence of disturbances of development and rhachitic alterations in the ears of a Cretin," and "On bilateral absence of the entire labyrinth," in these ARCHIVES, vol. xi., 1 and 236. In both of these we found the body and head of the stapes represented by a rod-like structure with a slipper-shaped transverse section, and in the second case the anatomical conditions, so far as the historical development was concerned, were such that we could not

assent in this case to the opinion of Parker and Gruber (to which, by the way, Schwalbe also agrees), that the stapes is developed from the labyrinthine capsule by cellular proliferation. This condition, on the contrary, seemed rather to favor the independent development of the stapes from the second branchial arch.

The last section is devoted to a description of the Eustachian tube. The author thus expresses his opinion upon the much-discussed question of the condition of this canal whilst in a state of rest: "No matter whether the osseous orifice of the portion of the tube terminates precisely at the isthmus, or extends a little further below the cartilaginous hook, at all events all anatomical and physiological observations up to this time agree in this, that the larger portion of the cartilaginous part of the tube is not patent in a state of rest, but represents a closed vertical fissure, which every now and then is opened either by the **simultaneous** action of the tensor and levator veli palatini, or by the **independent action of the former alone.** Nevertheless, the orifice may also be opened independently of the act of swallowing, by the sole action of the tensor.

The method in which the levator acts is explained by assuming that in the pharyngeal region of the tube its belly is thickened by contraction, and that thus the membranous floor of the tube is raised, and the walls pressed apart. It is impossible for the contraction of the corresponding muscular fibres in the posterior superior portion of the tube alone to enlarge the orifice of the tube, for they will rather elongate the capillary vertical fissure, pull out the folds on the mucous membrane of the floor, and thus fix that portion of the tubular wall.

With the description of the ostium pharyngeum tubæ, a short comparato-anatomical sketch of the muscles of the tube, the structure of its cartilage, the folds of its mucous membrane, as well as a retrospect of the nerves and vessels of the middle ear, and finally with otological literary references, this work terminates; a book, rich in excellent illustrations, and one most warmly to be recommended to our fellow-practitioners from a scientific as well as a practical point of view.

Types of Different Forms of Deafness Graphically Represented, according to the results of various hearing-tests with tuning-forks of varying pitch. By Dr. ARTHUR HARTMANN. Fischer, 1886, Berlin.

Reviewed by E. Schulte, Milan.

The hope expressed by the reviewer on the publication of his preliminary communication (*Deutsch. med. Wochensch.*, xv., 1885) on the graphic representation of hearing tests with the tuning-fork, that by means of this new method a visible, easily-comprehensible picture of any existing degree of deafness might be obtained, has not been unjustified, as the paper now before us testifies. To tell the truth, our hopes have been wholly realized, in this recent work, showing as it does the various types of numerous forms of deafness, as discovered after long and careful individual investigation, the results of which the author has registered according to his method. The remarkably striking and constant relation between the results of tuning-fork tests so obtained and registered, and the different forms of deafness so apparent at the first glance at the plates, ought sufficiently to incite every reader to investigate the question for himself and to form his own opinion. For this purpose the table for the hearing-tests, as well as the accompanying diagrams, will be very welcome.

Atlas of Otoscopic Pictures of the Membrana Tympani. By Prof. K. BUERKNER. With fourteen plates chromolithographed from the author's original sketches, by Adolph Giltsch. Jena, 1886.

Review by GOTTSTEIN.

No one in our day will doubt that a correct interpretation of the pathological alterations in the *Mt* is the prime necessity in the recognition of diseases of the ear. The accuracy needed for this knowledge the beginner can largely obtain by the frequent otoscopic examination of patients. Nevertheless, experience teaches us that in clinical cases it is almost impossible to make the learner understand what he is seeing or what is going on, unless some drawings are at hand. The teacher cannot get along without board and chalk if he hopes to make the appearances in the *Mt* comprehensible to his scholars. Burckhardt-Merian's charts for delineating the condition of the organ of hearing supplement this need in a useful and enlarged manner. More valuable than these, however, are pictures, which reproduce the manifold tints and shades which the skilled observer can discover from pathological alterations in the *Mt.* Most German text-books on otology make a shift without the help of illustrations. Politzer's "Wall Plates" have long since disappeared from the

book shops, and Buerkner therefore felt that he would be filling a want if, upon the foundation of some water-color sketches, which he had in the course of years thrown off for otoscopic instruction, he built up for the general benefit of the profession at large a chromo-lithographed and systematically arranged collection of pictures representing the most important typical affections of the *Mt.*

We unreservedly acknowledge the necessity for these pictures, and gladly take this opportunity of thanking the author for so successfully accomplishing his great task. There are eighty-four sketches on fourteen plates (only forty-eight in Politzer's collection), and the most experienced aurist will hardly fail to find somewhere within the atlas an illustration of every pathological condition of the *Mt* that he is likely to have seen. The drawings throughout betray the careful observer, and the chromo-lithographic reproduction, considering the enormous difficulties in the way of exhibiting objects so rich and varied in tints and shades, may truly be regarded as highly successful. Of course, if any one attempts to learn otoscopy wholly or largely from this (or any other) atlas, he will fall into many an error, despite any explanation that may be added in the margin, and the author does not by any means recommend his work as a self-teaching affair, but solely as an assistance for comparing with the drawings the alterations perceived in the objects examined, and thus for obtaining more accuracy in the recognition of various anomalies. As the atlas does not render a text-book indispensable, the author has limited his notes to a short description of each picture. An excellent index greatly facilitates the finding of various sketches of the *Mt*, intended to represent any particular pathological alteration.

We are convinced that the atlas will soon become an indispensable necessity to the clinical lecturer, and to the practising aurist a most desirable counsellor in many a difficult case of diagnosis of the true condition of the parts; and we can only hope additionally that the general practitioner who neither abandons his aural patients to their fate, nor sends them to the nearest aurist, will busily make use of the atlas, in order to accustom himself to the accuracy that is needed in this method of observation and diagnosis.

A Practical Manual of Diseases of the Nasal Fossæ, and of the Naso-Pharyngeal Space. By Dr. E. J. Moure.

With fifty-three illustrations in the text, and four lithographic plates. Paris, Doin, 1886.

Notice by Dr. Arthur Hartmann.

Moure's book depicts the diseases of the nose and naso-pharynx in a compendious fashion. The author has done nothing more than to collect the most important points that the practising physician will be most likely to need. The book contains simply a copy of the views at present prevalent, and does not advance any important or novel theories. The collection can be regarded as a success from the standpoint of the purpose for which it was intended, and it may really be of use in interesting and urging to further study those who at present stand on the threshold of this interesting branch of medicine.

The Diagnosis and Treatment of Diseases of the Ear. By OREN D. POMEROY. *Second edition revised, with additions.* D. Appleton & Co., New York, 1886. Price, $3.00.

A Clinical Manual of the Diseases of the Ear. By LAURENCE TURNBULL. With a colored lithographic plate and numerous illustrations on wood. *Second revised edition.* B. Lippincott Company, Philadelphia, 1887. Price $3.00.

The Diseases of the Ear and their Treatment. By ARTHUR HARTMANN, of Berlin. Translated from the third German edition by JAMES ERSKINE, Glasgow. G. P. Putnam's Sons, New York, 1887. Price, $2.75.

Reviewed by H. Knapp.

POMEROY'S book, the first edition of which appeared in 1883, appears now as a handsomely gotten up volume of 413 pages with 100 illustrations in the text. It is a thoroughly American book; the practice followed and recommended, and the literary sources used, are predominantly those of this country. Yet the Europeans have not been slighted, the author being over-scrupulous in giving credit. To quote an example: page 33. "Urbantschitsch states, in his work on the ear, that in some elderly people with normal hearing the bone-conduction is defective [Politzer]." Pomeroy might have omitted both authors without doing injustice to either. His book is written with a great deal of industry and circumspection; the style is easy and clear. The chief feature of the work is the constant aim at being useful to the practitioner. From this point he describes the symptoms of each disease, illustrates them by numerous, very numerous, cases taken from his own practice

and from literature, and dwells on the details of treatment and operations. The book will be read with interest and profit by the aural as well as the general practitioner ; for the medical student it is too long.

TURNBULL'S work—567 beautifully printed pages, profusely illustrated, heavy paper—has sold so large a first edition as 1700 copies. It has peculiar features. The first is a disconnected arrangement of its subject-matter. It is not an orthodox school-book, proceeding from the external ear through the tympanum and inner ear to the auditory centre in the brain in a systematic manner, but it is rather a collection of essays on kindred subjects.

The second peculiar feature is the liberal use of the quotation marks. What percentage of the whole text the part so ornamented constitutes, I have not computed. If this remark should, however, induce somebody to believe that the book lacks originality, he would be greatly mistaken. There are, in this book, a great many most valuable observations and suggestions personal to the author, and they have been extensively quoted in otological literature. All persons that pay more than a passing interest to aural surgery will be amply rewarded by reading Turnbull's book, which gives full information on some important subjects that are scarcely mentioned in others.

HARTMANN'S work is a school-book and an excellent one. It is clear and concise, leaving out unessential matter but nothing that is of scientific or practical interest. It is brought down to the latest stand-point of aural science and art. It is thoroughly systematic, and though it bears the stamp of the personality of the author —whose scientific attainments and large experience are manifested on every page by the precision of his descriptions and the forcibleness of his statements,—it fairly and impartially represents our total stock of knowledge in this department. Here and there the author dwells too long on subjects of personal predilection ; for instance, the testing with tuning-forks of different pitch, leading him to the assumption of four different types of ear disease, illustrated by diagrams of auditory acuteness, receives too much space in a book destined for the student and general practitioner. The book has 283 pages ; is excellently well printed on handsome paper, and the translation is both faithful and perfectly English. Though there is a galaxy of text-books on otology, Hartmann's is sure to be as great a favorite with the English-American student as it has proved with the German.

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